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,, ,, 29 *for* **pœcilorynch****a** *read* **pœcilorhyncha.**
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,, 516 ,, 2 from bottom *for* **leucogastar** *read* **leucogastra.**
,, 524 ,, 33 *for* **Blandford** *read* **Blanford.**
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,, 694 ,, 13 *for* **piscotor** *read* **piscator.**
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Champion, H. G. (I.F.S.)	Dehra Dun.
Charles, F. D.	Bombay.
Chaudhri, C. M. (I.F.S.)	Angal.
Chevenix-Trench, C. G. (I.C.S.)	Udaipur.
Chevenix-Trench, Mrs. C. G.	,,
China, The Science Society	Namking.
Chislett, E. V. D.	Belgaum.
Chopra, Dr. B. N. (D.SC.)	Calcutta.
Claudius, C. D.	London.
Clee, C. B. B. (I.C.S.)	Bombay.
Clifford, Lt.-Col. R.	London.
Clifford, W. Walters	Jalgaon.
Clough, R. J.	Calcutta.
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Bombay Club The Honorary Secretary	Bombay.
Bombay Gymkhana Club, Ltd., The Secretary	,,
Byculla Club, The Honorary Secretary	,,
Club of Western India, The Honorary Secretary	Poona.
Cuttack Club, The Honorary Secretary	Cuttack.
Darjeeling Club, Ltd.	Darjeeling.
I. D. Gymkhana Club	New Delhi.
Kolar Gold Field Club	Oorgaum.
Madras Club, The Secretary	Madras.
Mawlaik Gymkhana Club, The Honorary Secretary	Mawlaik.
Maymyo Club, The Secretary	Maymyo.
Muktesar Club, The Honorary Secretary	Muktesar.
Naini Tal Club, Ltd., The Secretary	Naini Tal.
Nerbudda Club, The Secretary	Jubbulpore.
Northern Shan States Club	Lashio, Burma.
Quetta Club, Ltd., The Secretary	Quetta.
Ranikhet Club, The Honorary Secretary	Ranikhet.

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Secunderabad Club Library, The Honorary Secretary	Secunderabad.
Sind Club, The Honorary Secretary	Karachi.
Srinagar Club, The Secretary	Srinagar.
Trivandrum Club, The Honorary Secretary	Trivandrum.
United Service Club, The Secretary	Bangalore.
United Service Club, Ltd.	Simla.
Wellington Gymkhana Club, The Honorary Secretary	Wellington.
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Cocke, Lady H. G.	Bandra.
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Cole, Lt.-Col. B. L.	Ajmer.
Cole, F. H.	Sukkur.

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American College, The Treasurer	Madura.
Assumption College, The Principal	Bangkok.
Baroda College, The Principal	Baroda.
Burma Forest School, The Director	Pyinmana.
Calcutta, The Presidency College	Calcutta.
Calcutta School of Tropical Medicine and Hygiene, The Director	,,
Carmichael Medical College, The Principal	,,
Central College, The Principal	Bangalore.
Central Research Institute, The Director	Kasauli.
China, The Science Society of China Library	Nanking.
Daly College, The Principal	Indore.
Deccan College, The Principal	Poona.
Forest Research Institute and College, The Forest Botanist	Dehra Dun.
Forest Research Institute and College, The Principal	,,
Government English School, The Head Master	Virajpet.
Gujarat College, The Principal	Ahmedabad.
Gwalior, Victoria College, The Principal	Gwalior.
Haffkine Institute, The Director	Bombay.
H. H. The Maharaja's College for Women	Trivandrum.
Indian Lac Research Institute	Namkum.
Institute of Plant Industry, The Director	Indore.
Intermediate College, The Superintendent	Bangalore.
Islamia College	Peshawar.
Karnatak College, The Principal	Dharwar.
King Institute, The Director	Guindy.
La Martiniese College, The Principal	Lucknow.
Ludhiana, Government Intermediate College, The Principal	Ludhiana.
Madras Forest College, The Principal	Coimbatore.
Maharaja's College, The Principal	Ernakulam.
Mayo College, The Principal	Ajmer.
Nowrosjee Wadia College, The Principal	Poona.

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Rajaram College, The Principal	Kolhapur.
Royal College of Medicine, The Professor	Baghdad.
Royal Institute of Science, The Principal	Bombay.
Scott Christian College, The Principal	Nagercoil.
St. Joseph's College, The Principal	Teppakulam.
Trivandrum, H. H. Maharaja's College for Women.	Trivandrum.
University College, The Principal	Rangoon.
University College, The Principal	Colombo.
Victoria College, The Principal	Palghat.
Victoria Technical Institute, The Curator	Nagpur.
Wilson College, The Principal	Bombay.
Colombo Museum, The Librarian	Colombo.
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Conley, Andrew	Jamaica.
Connor, Col. Sir Frank (*Kt.*, D.S.O., I.M.S.)	Bombay.
Conservator of Forests, Bhopal State	Bhopal.
Conservator of Forests, Cochin Government	Chalakkudi.
Conservator of Forests, Working Plan Circle	Maymyo.
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Cooper, Khan Bahadur D. B. (M.L.A.)	Satara.
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Cousins, Capt. C. W.	London.
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Cowasji Jehangir, Sir, *Kt.* (Jr.) (K.C.I.E., O.B.E.)	Bombay.
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Crawford, William G. (I.F.S.)	Rangoon.
Crerar, Sir James (K.C.S.I., C.I.B., I.C.S.)	England.
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Crombie, A. D. (I.C.S.)	Madras.
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Cunningham, G. (C.I.E., O.B.E., I.C.S.)	Peshawar.
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Dalal, Miss Perin P. M.	,,
Dalal, Dr. Phiroz A. (L.M.S., D.T.M. & H.)	,,
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Danson, J. W. W.	Rangoon.
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Darjeeling, The Curator, Nat. Hist. Mus.	Darjeeling.
Daultana, Khan Bahadur Mian Ahmadyar, M.L.C.	Luddan.
Davenport, Major C. (O.B.E., R.A.V.C.)	Bombay.

Daver, Framroze A.	Bombay.
Daver, The Hon'ble Mr. J. D. (Bar.-at-Law)	,,
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David, Meyer I.	Bombay.
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Davidson, M. N. D.	Lampang.
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Davies, Capt. V. K. N. (I.A.)	Bombay.
Davis, G. (I.C.S.)	,,
Davis, P. W. (I.F.S.)	Mangalore.
Davis, Dr. W. St. T.	Dwarbund.
Dawkins, C. G. E. (I.F.S.)	Rangoon.
Delacour, Mons. Jean	France.
Delme-Radcliffe, Lt.-Col. A. (D.S O.)	London.
Dent, T. V. (I.F.S.)	Darjeeling.
Deo, Sri Balavadra Narayan Bhunj	Keonjhargarh.
deRhe Philipe, G. W. V. (F.E.S.)	London.
Deutsche Forschungsgemeinschaft, The Beschaffungsamt	Berlin.
Dewas (Sr.) Prince Vikram Singrao	Kolhapur.
Dickson, Lt.-Col. H. R. P. (C.I.E.)	Persia.
Dinajpur, Maharaja Jagadish Nath Ray	Dinajpur.
Dinshaw, Kaikobad Cowasjee (J.P.)	Bombay.
Director of Museums, S. S. & F. M. States	Kuala Lumpur.
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Dobson, Roderick	Passara.
Dods, W. K. (C.I.E.)	Calcutta.
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Donald, D. R.	Pyinmana.
Donald, Lt. J. O. S.	Chitral.
Donovan, Lt.-Col. C. (I.M.S.)	England.
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Drake-Brockman, Lt. R. F. H. (R.A.)	Bangalore.
Drake-Brockman D. L. (C.I.E., I.C.S.)	Bareilly.
Dubash, J. K.	Bombay.
Duke, A. H.	Bangkok.
Duke, J. A.	Nagpur.
Dunbar-Brander, A A. (O.B.E., I.F.S.)	Elgin, Scotland.
Duncan, Capt. D. L.	Loralai.
Duncan, John E. (P.W.D.)	London.
Duncan, P. R. (I.F.E.S.)	Dehra Dun.
Duncan, Major W. E. (D.S.O., N.C., R.A.)	Naini Tal.
Dundas, A. D. F. (I.C.S.)	Delhi.
Dunkley, E. J.	Rangoon.
Dunlop, Dr. W.	Baghdad.
Dunn, C. W. (C.I.E., I.C.S.)	Rangoon.
Dunsdon, A. C.	Lucknow.
Dyer, Dr. J. C.	Meerut.
Eates, K. R.	Sukkur.
Ebden, J. W.	Rangoon.
Edmonds, A. C.	Bellary.
Edwards, M. Vincent (I.F.S.)	Rangoon.

Eliot-Lockhart, Lt. Wm.	London.
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Elliott, A. G. C.	Jammu.
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Ellis, Ralph Jr.	California.
Ellis, S. F.	England.
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Emerson, Capt. J.	Bombay.
Evans, E. J.	Calcutta.
Evans, Col. G. H. (C.I.E., F.L.S.)	London.
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Evans, Brigadier W. H. (C.S.I., C.I.E., D.S.O.)	Quetta.
Evershed, John	Ewhurst, England.
Ewbank, R. B. (C.I.E., F.L.S., I.C.S.)	Bombay.
Ezra, Alwyn (F.R.G.S., F.Z.S.)	,,
Fawcus, L. R. (I.C.S.)	Calcutta.
Fedtschenko, Prof. Boris	Leningrad.
Ferard, R. L.	Bombay.
Ferrar, Lt.-Col. M. L. (I.A., O.B.E.)	England.
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Field, Capt. F. D. S. (I.M.S.)	Udaipur.
Field, Frank (M.B.O.U.)	London.
Field, G. G. (I.P.S.)	Saharanpur.
Fletcher, Thos. Bainbrigge (F.E.S.)	England.
Florence, James	Kievcote.
Flynn, A. A. (C.M.Z.S.)	Karachi.
Fooks, H. A.	Calcutta.
Forrington, A.	Bombay.
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Foulkes, R.	Madura.
Fountaine, Miss Margaret (F.E.S.)	London.
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Fraser, Duncan	London.
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Gallant, M. N. (B.SC., I.F.S.)	London.
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Gamlen, R. L. (O.B.E., M.I.E.E.)	Hyderabad, Dn.
Garbett, C. C. (I.C.S.)	Lahore.
Gaye, W. C.	Arlington.
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Gentle, J. A. R. (I.F.S.)	Chanda.
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George, Hugh S. (I.F.S.)	Betul.
Gibson, E. C. (I.C.S.)	Ajmer.
Gilbert, C. E. L. (I.F.S.)	Karachi.

Gilbert, T.	Europe.
Gill, E. H. N. (F.Z.S.)	Budaun.
Gill, H. A. C.	Kulu.
Gill, H. E. P.	London.
Gimson, C. (I.C.S.)	Sylhet.
Gladstone, Capt. H. S. (F.Z.S., F.R.S.E.)	Capenoch, Scotland.
Gladstone-Solomon, Capt. W. E. (I.E.S.)	Bombay.
Glass, E. L.	Ranchi.
Glennie, Major E. A. (D.S.O., R.E.)	England.
Godfrey, E. J. (B.SC.)	Bangkok.
Goldie, Dr. E. A. (M.C., I.M.S.)	Lahoal, Assam.
Gondal, Kumar Shree Nutversinhji	Jetalsar.
Goord, T. D.	Baghdad.
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Gordon, R. G. (I.C.S.)	England.
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Gregson, T. S.	Bombay.
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Guzder, H. B.	Bombay.
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Hicke, Major F. C.	Poona.
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Higginbottom, Dr. Sam	Allahabad.
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Hora, Dr. Sunder Lal (D.SC.)	Calcutta.
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Hotz, E.	Agra.
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Howell, Sir Evelyn (K.C.I.E., C.I.E., I.C.S.)	London.
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Iswardas Lukhmidas	Bombay.
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Jackson, Dr. T. S.	Bombay.

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Johnson, Kay	Moran.
Jones, A. E.	Simla.
Jones, A. J. (I.P.)	Rangoon.
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Junagadh, His Highness the Nawab of	Junagadh.
Kanga, Miss P. M. (M.SC.)	Bombay.
Karachi, Victoria Museum, The Curator	Karachi.
Katrak, M. N.	Bandra.
Kazi, E. D. (J.P.)	Bombay.
Keays, Lt.-Col. R. W. C. (I.A.)	Madras.
Keip, Oscar	Bombay.
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Kermode, C. W. D. (I.F.S.)	London.
Khan, Sahebzada Sardar Mahomed	Karachi.
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Knight, H. F. (I.C.S.)	Sholapur.
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Kothavala, T. T.	Surat.
Krishnalal, Rai Bahadur Capt. (D.R.T.C., M. I. E. & S., A.F.R.A.S.)	Indore.
Kuroda, Dr. Nagamichi	Tokyo.
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Langdale, A. H.	Bombay.
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Latham, H. D.	Vellore.
Latif, Sarhan C.	Karachi.
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Laud, D. S.	Bombay.
Laurie, M. V. (I.F.S.)	England.

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Lee, Capt. G. H. (M.C.)	Balaghat.
Leech, Mrs. A. J.	Kodaikanal.
Lees, L. M. (I.C.S.)	Rangoon.
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LeMarchand, W. M.	Dibrugarh.
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Leonard, Lt.-Col. W. H. (I.M.S.)	Bombay.
Leonard, P. M. R. (O.B.E.)	Rangoon.
Levett, R. W.	Ootacamund.
Ley, Hon'ble Mr. A. H. (C.S.I., C.I.E., I.C.S.)	London.
LIBRARIES—	
Agricultural Library, The Librarian, U. P.	Nawabgunj.
Allahabad Public Library, The Secretary	Allahabad.
Annamalai University Library	Annamalai.
Benares, Hindu University Library, The Librarian	Benares.
Burma, Bernard Free Library, The Honorary Librarian	Rangoon.
Hyderabad, The Librarian, State Library	Hyderabad, Dn.
Imperial Library, The Librarian	Calcutta.
Lahore, University of Punjab, The Librarian	Lahore.
Lucknow University Library	Lucknow.
Madras, Connemara Public Library, The Principal Librarian	Madras.
Neilson Hays Library	Bangkok.
Nilgiri Library, The Honorary Secretary	Ootacamund.
Public Library, Museums and National Gallery of Victoria, The Chief Librarian	Melbourne.
Public Library, Museum and Art Gallery, Adelaide.	S. Australia.
United Service Library, The Honorary Secretary	Poona.
Lightfoot, Capt. G. S. (I.P.)	Jorhat.
Lightfoot, S. St. C.	Taunggyi.
Limbdi, H. H. Maharana Shri Sir Daulatsinhjee (K.C.I.E.)	Limbdi.
Limbdi, The Yuvaraj Saheb of	,,
Lindley-Hinde, G.	Calcutta.
Lister, R. S.	Ghoom, Bengal.
Little, E.	Kirkee, Poona.
Locket, A.	Numaligarh.
Lodge, G. E.	England.
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Longbottom, Capt. J. L.	England.
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Lowsley, C. O.	England.
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Lucknow, Provincial Museum, The Curator	Lucknow.
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Lutyens, F. M. B.	Calcutta.

MacColl, H. H. (I.E.S.)	London.
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MacDonald, R.	Chubwa.
Macdonell, J. F.	Bombay.
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MacGusty, H. M.	,,
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Mackenzie, J. M.	Calcutta.
Mackenzie, T. J.	Indore.
Mackenzie, Wm.	Udamalpet.
Mackereth, J. (I.F.S.)	London.
Mackie, A. W. W. (C.I.E., I.C.S.)	Poona.
Mackie, Bt.-Col. F. P. (I.M.S., O.B.E., K.H.S.)	England.
Mackinlay, Lt.-Col. Chas.	Edinburgh.
Mackwood, F. E.	Colombo.
MacLachlan, D.	Poona.
MacLachlan, R. B.	Karachi.
Macleod, A. (I.C.S.)	Bournemouth.
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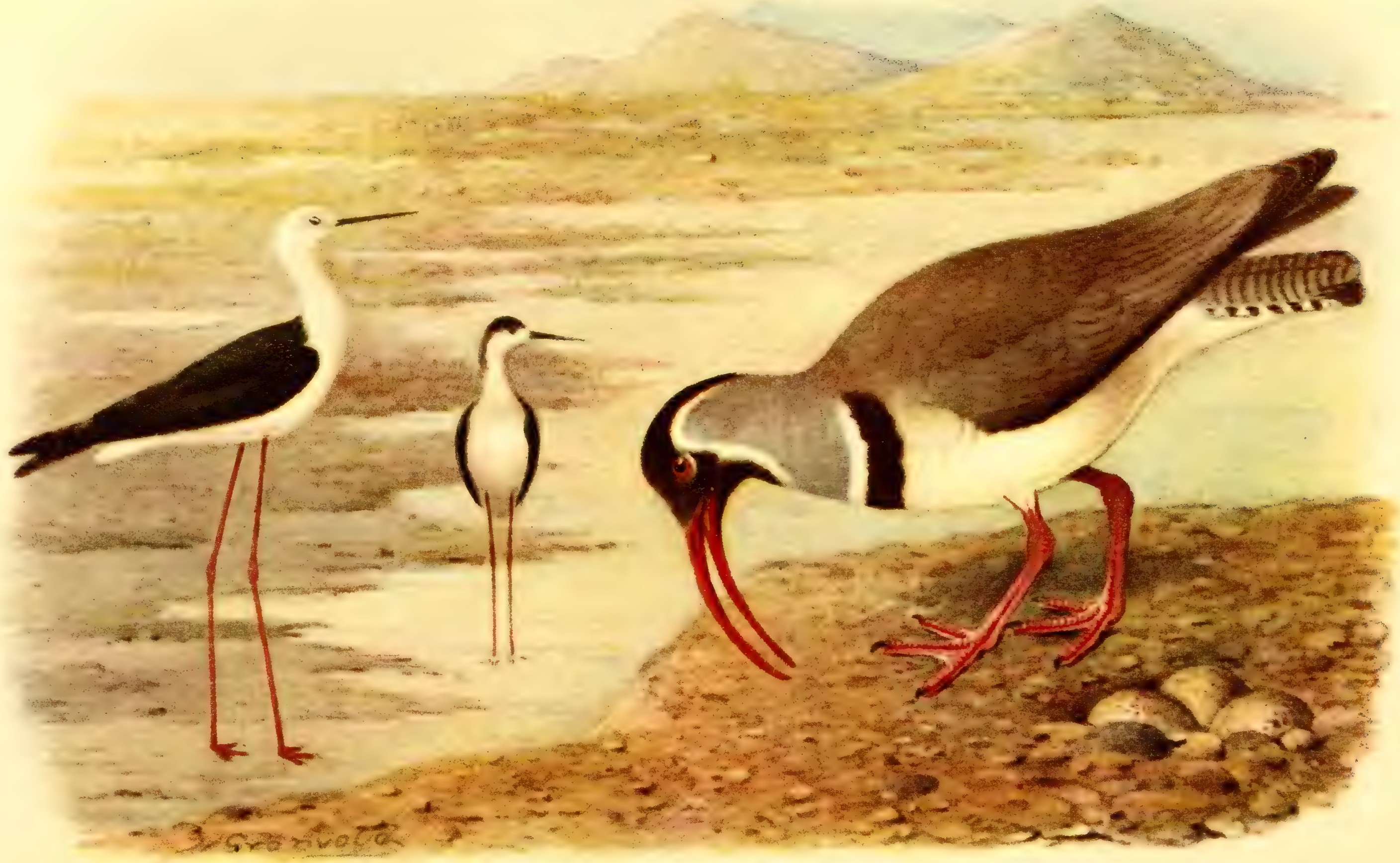

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THE BLACK-WINGED STILT. 1/5
Himantopus h. himantopus
Male adult. juv.

THE IBIS-BILL. 1/3
Ibidorhyncha struthersii.

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OF THE
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FEBRUARY, 1932. VOL. XXXV No. 3

THE GAME BIRDS OF THE INDIAN EMPIRE.

BY

E. C. STUART BAKER, C.I.E., F.Z.S., F.L.S., M.B.O.U., H.F.A.O.U.

VOL. V.

THE WADERS AND OTHER SEMI-SPORTING BIRDS.

PART XVI.

(*With a coloured plate*).

GENUS : HIMANTOPUS.

Himantopus Brisson, Ornith., i, p. 46 ; v, p. 33 (1760).

Type by taut., *Charadrius himantopus* Linn.

In this genus the most remarkable character is the great length of the legs, the tibia being very long, as well as the tarsus, and bare over about three-quarters of its length ; the tarsi are reticulated throughout; there is no hind toe and the outer toe is joined to the middle toe by a broad web, that between the inner toe and middle toe being narrower ; the bill is long, straight and slender, the dertrum not swollen ; the nostrils are long slits placed in the base of a groove which runs about half the length of the upper mandible ; the wing is long and pointed, with the first primary longest ; the tail is short and even.

Stilts are resident birds in nearly all tropical and temperate countries ; one species of very wide range occurring in India.

HIMANTOPUS HIMANTOPUS HIMANTOPUS.

The Black-winged Stilt.

Charadrius himantopus Linn., Syst. Nat., 10th. ed., i, p. 151 (1758) (Southern Europe) ; Stuart Baker, Fauna B. I., Birds, vi, p. 193, 1929.

Vernacular Names.—Gaj-paun, *Tinghur* (Hind.) ; *Lal-Gon*, *Lal-thengi*, *Lam-gora* (Beng.) ; *Gusling* (Sind).

Description : Adult Male.—Mantle and wings, above and below, black, glossed with metallic green ; upper tail-coverts tinged with brownish-grey ; tail delicate, pale, grey-brown; remainder of plumage white, a few black spots often showing on the head.

Colours of soft parts.—Iris bright red; bill black; legs and feet crimson-red, the claws black.

Measurements.—♂ Wing 240 to 253 mm.; tail 80 to 86 mm.; tarsus about 115 to 145 mm.; culmen 60 to 69 mm.

♀ Wing, 227 to 236 mm.; culmen 54 to 68 mm.

Females have the back, scapulars and inner secondaries brown instead of black; the white head is nearly always sullied with some grey, whilst the hind-neck also often shows some grey.

Young males have the anterior crown, upper ear-coverts and a line down the back of the neck black.

Nestling.—Upper plumage pale fulvous, mottled with black, this forming very indefinite lateral and a distinct median coronal line; there is a fairly distinct dorsal line with an arrow-head cross-line on the shoulders and extreme rump.

Distribution.—Southern Europe, Africa, Central and Southern Asia to Ceylon, Malay Straits, etc. In India, the Stilt is very generally distributed wherever there is suitable country near, but on the other hand there are wide areas where I think it never occurs at all or merely as a wanderer during the cold weather.

Nidification.—The Stilt is a resident bird breeding wherever it is found, provided there are suitable places. It makes its nest in swamps and marshes, sometimes actually in the shallow water, sometimes on little islands or on the edges of the swamps. Its time of breeding is governed to a great extent by the question of water-supply, though the majority of birds seem to nest during April and May, before the rains break, when there is a vast extent of shallow muddy water with an ample supply of food. In former days they used to breed in vast numbers on the Sultanpoor salt works, about 35 miles south of Delhi. The birds were present round about these works throughout the year, but about the middle of April they began to congregate in great numbers. The salt works consisted, according to Hume, ' of brine wells and many hundred acres of shallow, rectangular, evaporating pans from 100 to 200 feet square and from 6 to 10 inches deep. These pans were merely depressions dug in the soil and lined with *chunam* or fine lime obtained by burning *kunker*, a nodular concretionary limestone found in beds near the surface more or less throughout the plains of Upper India. Small strips of ground from a foot to five or six feet broad divide the pans, where only a little brine ever stands. On these the Stilts build their nests.'

' They collect together small pieces of *kunker*, or the broken lime-lining of the pans, into a circular platform from seven to even twelve inches in diameter and from two to three inches in height; on this, again, they place a little dry grass, on which they usually lay four eggs, but, not infrequently, only two or three. They begin to lay, according to season, towards the end of April or the beginning of May; and by the beginning of June, numbers of young are to be seen about, and by the 1st July most of the eggs that remain are hard-set. The majority of the birds lay during June, earlier or later according to season.'

'The temperature of the nest at this time in the full sun probably averages quite 140° Fahrenheit.'

Doig records it as nesting in a somewhat similar situation in the Eastern Narra in June, where they make their nests on the salt-encrusted ground. They also breed in the marshes of Sind, but here they are sometimes driven away by the drought which completely dries up all water of their breeding places. Even then, however, a few pairs will sometimes stay, as Ticehurst records three pairs of Stilts breeding on the Khinjur Lake at Jhimpir reduced by the drought to a sheet of water less than half a mile around. The nest varies considerably in construction. Those laid on dry ground, such as the saltpans, consist of little platforms of broken limestone or *kunker*, varying from seven to twelve inches in diameter and from two to three inches in height. Sometimes these are lined with a little grass, sometimes they are quite unlined. At other times the nest is a mere platform of earth, or just a hole is scraped in the ground and lined with small stones or similar material. When made in muddy soil or actually in the water, the nest is often of considerable size consisting of a pile of water-weeds, stones and other rubbish, sometimes as much as a foot in height and comparatively broad. On the top of this pile a small depression is made with a little dry lining on which the eggs are deposited. Sometimes the nests are scattered about over a considerable area but at other times they are made close together; thus Hume records finding 38 nests on a strip of high dry ground three feet wide and a hundred feet long, in addition to which there were five nests of the Red-wattled Lapwing.

In Mesopotamia, where Pitman found them breeding in vast numbers on the Musseyib marsh, Euphrates Valley, the nests were often so close together, that the sitting birds almost touched one another; here the nests were nearly all on little islands, but even in such places the nests were bulky affairs, whilst some of those built in the shallow water were over two feet in height. In Ceylon, these birds seem to have two breeding seasons: the first, from early March to May, and the second, in the North, during July and August. There the birds breed both in marshes and on the great inland lakes, where they generally make use of small islands. The number of eggs laid seems to be either four or three, though a great many birds only lay two eggs, whilst five have been found in the same nest once or twice. In appearance the eggs are distinctly like those of the plover's but decidedly less pyriform than most. The colour varies very little, nine eggs out of every ten having a ground colour of greenish brown or light brown marked with spots, specks and blotches, or occasionally streaks of black, blackish brown or rich umber brown. Secondary markings very seldom occur, and when they do, they are of a rather dark inky grey. The markings are distributed fairly numerously over the whole surface but generally more numerously at the larger end, and nowhere thickly enough to obscure the ground colour. In a few eggs the tint may be anything varying from a pale yellow or yellow-grey stone colour to a warm tint of the same, but such eggs are exceptional.

In shape the eggs are rather long and pyriform with a smooth and often a silky texture. Jourdain gives the average of 100 European eggs as 44·0 by 31·0 mm. Eggs taken in Mesopotamia average rather larger; forty-two averaging 45·1 by 30·7 mm. with a maximum of 48·2 by 33·0 mm., the smallest being 38·0 by 28·0 mm. A hundred Indian eggs on the other hand average almost exactly the same as the English eggs, that is to say, 43·8 by 30·8 mm.

In Ceylon, Waite found them breeding in small grassy islets in the salt lakes, where they made no nests beyond a thin lining of reeds to a shallow scratching in the ground. In Southern Burma, where they have also been found breeding, the nests were described as comparatively thick masses of muddy weeds lined with a few dry ones.

The birds are very clamourous round their breeding grounds, circling over an intruder's head, uttering loud cries the whole time. They are not shy birds when nesting and, generally, allow a fairly close approach to the nest before taking their departure whilst, in the days when they bred in the salt works, they got so used to human beings passing backwards and forwards that they would continue to sit on their nests even when the workers came within a few inches of them.

One would have imagined that to birds with such immensely long legs, sitting on their nests would be a matter of no little difficulty but, as a matter of fact, they seem to tuck them up under themselves just as comfortably as the short-legged birds can.

Habits.--This is a resident bird though it may be forced to make local migrations in times of drought or in the wetter parts when there are heavy floods. It is always a gregarious bird and it will nearly always be found in small parties though occasionally single birds and pairs wander away some distance in search of food. In the breeding season the smaller parties collect in still bigger flocks and, as has already been remarked, some of their breeding colonies number many hundreds. On the wing the Stilt has an easy, rather flapping flight, though it is capable of moving at a considerable pace when frightened. Its slight form, with the long thin legs trailing behind, give it a rather curious appearance, recognizable at a great distance. When feeding, it usually walks slowly and quietly about in the shallow water, though it can run at some speed and it also swims well. Its food consists principally of aquatic and other insects, fish-fry, frog-spawn and tadpoles, small frogs, lizards, etc., as well as small mollusca.

GENUS: RECURVIROSTRA.

Recurvirostra Linn., Syst. Nat., 10th ed., i, p. 151 (1758).

Type by mon., *Recurvirostra avocetta* Linn.

In this genus the bill is very long, flexible, curved upwards towards the tip, depressed and with both mandibles flattened; the nostrils are placed near the base in an ill-defined groove, which extends over less than half the upper mandible; the tarsi and tibia are long and bare, the former reticulated; there is a small hind toe and claw and the anterior toes are deeply webbed, the webs notched in the middle; the wing is long, the first primary longest.

As in the preceding genus, *Himantopus*, the value of the differences in these birds has been considered from various points of view by different systematists, some considering them merely of subspecific value, whilst others consider them to be not only specific but generic. One species, the type of the genus, occurs in India.

RECURVIROSTRA AVOCETTA AVOCETTA.

The Avocet.

Recurvirostra avocetta Linn., Syst. Nat., 10th ed., i, p. 151 (1758) (Europe, Oland); Stuart Baker, Fauna B.I., Birds, vi, p. 195, 1929.

Vernacular Names.—Kusya Chaha. (Behar).

Description.—Upper part of head and neck, scapulars and a line over the shoulders in continuation, median wing-coverts and inner secondaries and primaries black; the longest secondaries greyish at the ends; the inner primaries with white bases; remaining plumage white.

Colours of soft parts.—Iris red-brown to red; bill black; legs and feet pale bluish-grey.

Measurements.—Wing 220 to 235 mm.; tail 86 to 90 mm.; tarsus about 84 to 90 mm.; culmen 84 to 91 mm. (*Hartert*).

In Winter the tail is greyish, the long secondaries more grey and less black.

Young birds have the black replaced by brown, the brown scapulars, coverts, etc., edged with paler brown, giving a mottled appearance.

Nestling in down.—Above pale grey; a black line through the lores and another down the centre of the crown with other black marks laterally; two broken dorsal lines of black and a well-developed black line down the posterior flanks joining round the tail; a few black blotches between this last and the dorsal lines; below dull white.

Distribution.—Breeding over the greater part of Europe; the Black Sea and the Caspian Sea to the Yenesei; Tropical Africa and South to North and Western India and Ceylon in winter.

Nidification.—The Avocet breeds nowhere within Indian limits but breeding colonies may be found as far west as Denmark and Spain. The colonies are sometimes of considerable size and the birds commence laying in the end of April, depositing their eggs either on the bare ground or in scratchings more or less well lined with vegetable debris. The site for the nest is in or around marshy land or sometimes in wet meadows of long grass, and the nest is generally well hidden, though I have seen nests occasionally in Denmark which were comparatively well exposed to any passer-by. The eggs, like those of all plovers, number four and are very like those of the Stilt, but average browner on the whole with rather darker and more definite markings, whilst they are also of course much bigger. Jourdain gives the average of a hundred eggs as 50·5 by 35·0 mm., max. *55·6* by 35·6 mm. and 50·4 by *37·5* mm.; min. *46·8* by 34·3 mm. and 48·3 by *31·2* mm.

Habits.—In India, this most beautiful bird occurs commonly in the North-West, from whence it decreases in numbers southwards, though it occurs in Ceylon whilst eastward it has occurred as far as

Behar. It arrives in India late in October though in the North-West a few birds may be met with in September, whilst Ticehurst has recorded it as early as the 28th of August. It leaves again in the end of March, the last few being seen as late as the second week in April. Ticehurst records having seen one as late as the 24th of May, whilst he saw yet another bird, apparently not breeding, on the 22nd of June at Jhimpir. In countries where it is more or less protected, the Avocet becomes very tame, but, where persecuted, it soon becomes very shy and wild, whilst in approaching its nest it is everywhere very cautious and suspicious. In India accounts of its wildness vary very greatly, and I have had it described to me by sportsmen as being sometimes exceptionally tame and confiding and at other times equally wild and difficult to approach. It keeps entirely to marshy lands, swamps and lakes, feeding on small crustacea, water insects, etc., obtaining its food by sweeping in the mud with a circular action of its curved bill as it walks quietly and slowly through the chalky shallows. It flies well, with its legs outstretched behind it and also swims well, sitting, like the Stilt, very high on the water. Witherby syllabifies its call as 'Klweet, klweet' and says that the male also has a low 'Chuck, chuck, chuck, chawy' which it utters on the ground.

GENUS: IBIDORHYNCHA.

Ibidorhyncha Gould, Century Birds, pl. 19 (1831).

Type by mon., *Ibidorhyncha struthersii* Gould.

This very curious genus still requires considerable study before its position can be finally settled. Pending this I follow Lowe in retaining it in the *Vanellinæ.*

The bill is hard, long, slender and curved downwards over nearly half its length; the nostril is linear and is placed at the base of the bill in a groove which extends over more than half the length of the bill; the tarsi are comparatively short and reticulated throughout; there is no hind toe; the outer and middle toes are connected by a deeply-indented small web, but that between the middle and inner toes is obsolete; the wing is very square, the first three primaries subequal and the inner secondaries almost as long.

IBIDORHYNCHA STRUTHERSII

The Ibis-Bill.

Ibidorhyncha struthersii Gould, Century Birds, pl. 19 (1831) (Himalayas); Stuart Baker, Fauna B.I., Birds, vi, p. 196, 1929.

Vernacular Names.—Puggah (Hill Miri).

Description.—Face as far back as the middle of the eye, throat and crown black bordered by white; the forehead and lores more or less speckled and streaked with white; neck, sides of head and upper breast bluish-grey, above merging into the ashy grey-brown of the upper plumage; rump-feathers with dark brown bases showing plainly; tail ashy-grey with narrow, wavy dark cross-bars, the other feathers with broad blackish subapical bars; primaries rather darker brown, the inner webs marked with white, indefinite broad margins to the first three or four, becoming well-defined white spots and bars on the innermost; a narrow white band below the grey-blue upper breast followed by a broad black gorget; axillaries, under wing-coverts and rest of lower plumage white.

Colours of soft parts.—Iris crimson; bill deep crimson-red to scarlet-red; legs and feet pinkish-grey (non-breeding and young) to blood-red (breeding adults).

Measurements.—Wing 230 to 245 mm.; tail 113 to 120 mm.; tarsus about 47 to 49 mm.; culmen 68 to 80 mm.

Young birds have no black and white on the head; the black breast-band is wanting or only just shows; the upper plumage has each feather narrowly margined paler.

Nestling in down.—Above grey, this tint formed by the most minute stipplings of blackish and white with, here and there, a tinge of fulvous; a darker line round the back of the head; a well-defined black and rufous line down the posterior flanks and round the tail; below greyish-white.

Distribution.—The Pamirs and Gilgit to North-West China, in Winter moving down to the foot-hills all along the Himalayas. In Assam it is common in the hill-streams where they debouch from the hills but never wanders any distance into the plains. In the Himalayas, in Summer, it occurs principally between 9,000 and 15,000 ft.

Nidification.—The breeding of the Ibis-Bill was first discovered by S. L. Whymper in April 1906, when he obtained nests in the streams of the Garhwal Hills between 8,000 and 9,000 feet. The same year Lieut. F. M. Bailey obtained its eggs from Gyantse, in Tibet. Since then it has been found breeding by Osmaston, Ludlow and others in Tibet, up to an elevation of at least 13,000 feet, whilst La Touche also obtained several nests on the Shinho River in North-East Chihli. Mr. Whymper thus describes his finding of the eggs:

'On May 5, 1906, I found the Ibis-Bill (*Ibidorhynchus struthersii*) breeding on the Bhaghirathi river—at about 8,000 feet. I got three clutches of eggs (four in each), there being, so far as I could make out, only three pairs of birds there. The nests, composed of small stones, were hollowed out and placed on sand and shingle among boulders and were very like a large nest of the Spur-winged Plover. I found two of the nests by watching the birds, but the first one I found by tracing back the tracks of a bird that was crouching and running along in this manner and at once flew back when flushed. I had to trace the tracks back well over a hundred yards before I came to a well-trampled spot and the eggs were at the side of it.'

'I sat down some way off to watch and the bird returned in about five minutes (the eggs were very hard-set), running almost straight to the nest and stood over it bobbing her head like a plover. She then sat down alongside the eggs, not actually on them, and this seems to be a habit of theirs as I saw another bird act in the same way when returning to its nest. The eggs in the different clutches vary a good deal in size, but the largest are 1·95 × 1·45 and are shaped very like a whimbrel's eggs. The ground colour is greenish-grey and they are spotted more or less all over but chiefly at the larger end with reddish-brown and pale purple, in colour and markings they are not unlike some terns' eggs. All the clutches were very hard set and indeed one would have hatched in a very few days. I was overjoyed at getting them, as I do not think they have been recorded before.'

'While hunting for these eggs I also found a fresh clutch of the Common Sandpiper (*Totanus hypoleucus*) in quite a neat little nest of twigs and pine needles under a boulder. I am not aware if this nest has been recorded from Indian limits before, though, of course, it breeds freely in Kashmir.'

Lieut. Bailey adds something to the description of the nest and says:

'The nest was situated on a stony island in the middle of the river here (13,000 ft.). The nest was made of small flat stones about ½ inch in diameter, forming a perfectly smooth and flat surface. I unfortunately did not measure the nest. The eggs, four in number, were laid with their points inward. This nest was taken on the 9th June when the eggs were hard set. On the same day I saw two birds with two young ones each. On my approaching, the young birds lay among the stones with their necks stretched out flat on the ground while the old bird endeavoured to draw me off in another direction, uttering loud cries. The young when crouching among the stones were very difficult to see, and lay so still that they allowed themselves to be picked up before showing any signs of life. The other three eggs were accidentally broken, so I have not attempted to blow the remaining one.'

The birds breed at least as high as 14,000 ft. though more often between 8,000 and 11,000 ft., and Mr. Macdonald, who sent me several clutches of the eggs of this bird, informs me that they were nearly always taken on islands in the middle of streams, though occasionally one might be found on shingle beds running into the river from the banks. Mr. Whymper also refers to this predilection of the birds for islands and writes: 'They are especially fond of nesting on the little islands which are numerous and sometimes rather hard to get at.' The nest is always placed right out in the open; I never saw one under the shelter of a stone or stranded log as is mentioned in the *Birds of India*; a common site is near the edge of a shingle bank. The nest is usually found by keeping a sharp look-out ahead and the bird will be seen running stealthily away. If the nest is not immediately discovered the bird will return to it in a short time. I have found fourteen nests in a few days, the eggs of which were well incubated although I was a fortnight earlier than in 1906. In four nests I found incubated clutches of three eggs, so it seems they sometimes lay three only. The nests have already been described and all those I saw were made as before, of little smooth black stones.'

La Touche had two eggs of this bird brought to him by his collector in 1915 from a stream in the mountains of Chihli and, on the second of the May following, he himself went out and found numerous nests, mere depressions among the stones of the shingly beach. The depressions were lined with small stones, all of much the same size. The breeding season of this bird seems to be restricted to

April and May. The earliest I have recorded is one taken on the 9th of April by La Touche and the latest, with fresh eggs, is one taken on the 29th of May and with hard set eggs on the 11th June. Birds, however, have been seen in their breeding places after their eggs had been taken, haunting the vicinity, and I have no doubt that they lay again and later than May in these circumstances. The eggs, I think, remind one more of the Woodcock's eggs than those of any other wader, but they are very pale and weakly marked. The ground colour is a very pale grey, tinted either greenish, yellowish or buff, whilst markings consist of small blotches and spots of light to dark reddish, with secondary markings of pale lavender. Both types of markings are fairly numerous at the larger end but scanty elsewhere, and in no eggs are the markings at all bold. Fifty-two eggs average 51·0 × 36·9 mm. ; maxima *53·0* × 36·0 mm. and 50·3 × *38·0* mm. ; minima *46·0* by *34·0* mm.

Habits.—In summer the Ibis-Bill keeps entirely to the banks and islands of rivers, between 8,000 and 15,000 feet, or perhaps even higher still. In Winter they seem to remain sometimes as high as 12,000 feet as they have been seen on the Gyantse Plateau all the year round. On the other hand, the majority of birds appear to wander down to the foothills and are to be found on most of the Himalayan rivers; where they debouch into the plains, though they never wander far into them. In Winter this species seem to be more common in the foothills in Assam than anywhere else, and Stevens records them as being found regularly every year on the Subansiri and other rivers between November and March. I have myself seen them on many of these rivers and saw one small party containing half a dozen birds on the Dunsiri as late as the fourteenth of April. They are said to be very wild in the breeding season, not allowing anybody to come within a considerable distance, but in winter they are distinctly not wild and I found them easy to approach within sixty to a hundred yards as they fed at the water's edge. The birds I saw were walking quietly about, feeding on the shingle, every now and then turning over small stones to quest underneath them. Those on the bare shingle were feeding on insects of various kinds, small mollusca and sandhoppers, but one I shot feeding on some shingle upon which there was a certain amount of scrubby grass and equisetum, seemed to have been feeding entirely on small grasshoppers. This latter bird allowed me to sit and watch it for at least twenty minutes before it rose up to leave, and was shot. On the wing it is not unlike a large sandpiper, though not, I think, so swift, whilst during the breeding season it is said to indulge in all sorts of acrobatic feats in the air, much like a pee-wit. The only note I have heard is a musical ' klew, klew,' but it is said to have a loud harsh call of fear and a similar warning note to its mate when sitting. It is a very graceful bird, both when walking and flying, and always seemed to me to be particularly charming to watch, so much so that I always felt a regret at turning one into a specimen, even though the flesh was extremely good to eat after the skin had been made ready for the museum.

(*To be continued*)

REVISION OF
THE FLORA OF THE BOMBAY PRESIDENCY.

BY

E. BLATTER, S. J., Ph.D., F.L.S.

PART XVII

(*With 3 plates and 1 text figure.*)

(*Continued from page 275 of this volume.*)

ORCHIDACEÆ.

BY

E. BLATTER, S.J., Ph.D., F.L.S. & C. McCANN, F.L.S.

12. PACHYSTOMA Blume (not in Cke.).

Terrestrial herbs ; rhizome underground, nodose. Leaves 1 or 2, long, narrow, plaited, often post-floral. Scape pale, with many sheaths. Flowers racemed, pendulous, moderate sized ; bracts large, scarious. Sepals and petals subequal, lateral sepals adnate to the base of the column. Lip sessile at the base of the footless column, erect, side lobes oblong, midlobe small ; disk with 3–5 deeply crested or fimbriate ridges. Column slender, clavate upwards. Anther dorsal, 4-celled ; pollinia 8, pyriform.

Species 8.—British India, China, Malay Archipelago, Papuasia, N. Australia, New Caledonia.

1. **Pachystoma senile** Reichb. f. in Bonpland. iii, 250 ; Hook. f. in F. B. I. vi. 812 ; King & Pantl. Ann. Roy. Bot. Gard. Calc. viii, t. 140 ; Ridley F., Malay Pen. iv (1924) 116 (*P. sessile per errorem*) ; Brühl Orchids Sikkim (1926) 75 ; Fischer Fl. Madras pt. viii (1928) 1426.—*P. Smithianum, Edgeworthii, montanum et Lindleyanum* Reichb. f. l.c.—*Apaturia senilis, Smithiana et montana* Lindl. in Wall. Cat. 3739, 3737, 3738 ; Gen. & Sp. Orchid. 130, 131.—*A. Lindleyana* Wight Ic. t. 1662.

Description : Rhizome 2·5–5 cm. Leaf solitary, very long and narrow. Scape with raceme 20–70 cm. long, white or nearly so. Sheaths 12 mm.–5 cm. long. Flowers about 12 mm. long, glandular pubescent, white, greenish or pinkish. Bracts scarious, longer or shorter than the flowers, strongly nerved. Sepals membranous, acute or acuminate, 5-nerved. Petals narrowly spathulate, acuminate, 3-nerved. Mentum very short. Lip from oblong to nearly orbicular, claw very short ; side lobes large, obtuse or subacute ; midlobe as long or longer, oblong or obovate, retuse or pointed, purplish ; disk with 5, rarely 3 crested ridges from the base to the midlobe, and there thickened. Column puberulous.

Locality : S. M. Country : Belgaum, in black soil of grass land, 2,600 ft., rainfall 50 in. (T. R. Bell 940 ! 941 ! 942 ! 943 !).

Flowered beginning of March 1926. ' The flowers were out at the beginning of March. The leaves were not fully up and grown until towards the middle of August and there was not a vestige above ground before the middle of July.' (T. R. Bell *in epist.*)

Distribution : Plains and foot-hills of N. India, from Garhwal to Sikkim, Khasia Hills, Manipur, Malay Peninsula, W. Ghats of Bombay and Madras (apparently not in Ceylon).

13. THUNIA Reichb. f. (Cke. ii, 692).

Species 4.—Indo-Malayan. There is only 1 species in the Presidency.

1. **Thunia venosa** Rolfe in Orchid Rev. xiii (1905) 206 ; Cke. ii, 692 ; Haines Bot. Bih. & Or. 1167 ; Fischer Fl. Madras, pt. viii (1928) 1427.—*Phajus albus* Lindl. (*partim*) ; Hook. f. in F.B.I. v, 818 (*partim.*).

This species had been mixed up with *Thunia alba* Reichb. f. This latter species can, according to Rolfe, be distinguished by the somewhat elongate raceme, by more and much larger flowers, by a yellow disk to the lip and a few lilac radiating veins on the side lobes.

Distribution: Kumaon, Mussoorie, Sikkim, Assam, Khasia, Burma, Chota Nagpur, W. Ghats of Bombay Pres., Travancore.

14. CALANTHE Br. (not in Cke.)

Terrestrial herbs, often pseudobulbous with a short or tall, leafy stem. Leaves plaited. Scape axillary, terminal or lateral from a leafy pseudobulb. Flowers medium sized, racemed. Sepals subequal, spreading, rarely connivent. Petals broad or narrow. Lip adnate to the top or base of column, 3-lobed, midlobe often 2-fid, disk lamellate or tubercled, with or without a spur. Column long or short, obliquely truncate ; foot O. Anther conical or convex, 2-celled ; pollinia 8, waxy, cohering in pairs by a granular viscus.

Species 120.—Warm countries. One species in the Bombay Pres.

1. **Calanthe Masuca** Lindl. in Wall. Cat. 7337 ; Gen. & Sp. Orchid. 240 ; Bot. Mag. t. 4541 ; Hook. f. in F.B.I. v., 850 ; King and Pantl. Ann. Roy. Bot. Gard. Calc. viii, t. 234 ; Fischer Fl. Madras, pt. viii (1928) 1432 ; Brühl Orchids of Sikkim (1926) 108.—*C. versicolor* Lindl. Sert. Orchid. t. 42 ; Bot. Reg. 1844, *sub tab.* 37.—*C. emarginata* Wight Ic. t. 918.—*C. Wightii* Reichb. f. in Walp. Ann. vi, 933.—*Bletia Masuca* Don Prodr. 30.

Description : A terrestrial herb. Stem short, stout. Leaves elliptic-ovate to lanceolate, acuminate, 25–50 cm. long, 7–15 cm. broad, sessile, or base tapering into a usually short petiole, usually sparsely pubescent, at least below, sometimes glabrescent. Scape lateral, stout, with the lax-flowered raceme up to 90 cm. long, sparsely puberulous ; bracts large, 20-25 mm. long, ovate-lanceolate, herbaceous, puberulous. Pedicels with ovary 3–3·7 cm. long. Flowers usually pale or dark purple, sometimes pale rose or white with a purple lip ; lip always bright coloured, 20-25 mm. long, puberulous. Sepals lanceolate, up to 3·7 cm. long, lip hardly exceeding the sepals, side lobes short, falcate-oblong, midlobe much larger, broadly or cuneately reniform, spur linear-subspathulate, longer than the sepals. Capsule 3·5 cm. long.

Locality : N. Kanara : Malemanighat (Sedgwick 7216 !).

Distribution : Tropical Himalaya from Nepal to Sikkim (1,500–4,000 ft.) Deccan Peninsula, W. Ghats of Madras Pres. (3,000–6,000 ft.), Java.

15. EULOPHIA R. Br. (Cke. ii, 693).

Species 200.—Warm countries of the Old World.

Cooke gives 4 species. We add another not known from the Presidency before : *Eulophia campestris* Wall.

A. Column not produced into a foot
  I. Leaves and flowers coetaneous or nearly so
    1. Lip longer than broad; side lobes of lip short or O
      a. Sepals 12 mm. long ; side lobes of lip O ... 1. *E. ochreata.*
      b. Sepals 2·2–3 cm. long ; side lobes of lip 3 mm. long ... ... 2. *E. herbacea.*
    2. Lip broader than long ; disk of lip with 3 crested nerves ... ... 3. *E. pratensis.*
  II. Flowers appearing long before the leaves ... 4. *E. campestris.*
B. Column produced into a foot ... ... 5. *E. nuda.*

1. **Eulophia ochreata** Lindl. in Journ. Linn. Soc. iii (1858) 24 ; Dalz. & Gibs. Bomb. Fl. 265 ; Hook. f. F.B.I. vi, 2 ; Cke. ii, 693 : Fischer Fl. Madras viii (1928) 1435.

Description : Cke. l. c.—Tubers sometimes 15 in a line. Scape up to 45 cm. Leaves dark green, plicate. Flowers pale cadmium yellow.

Locality : Gujarat : Khodwa, Panch Mahals (Raoji !).—*Konkan* (Stocks) ; Salsette, hills east of Tulsi Lake, in red earth in fairly open forest (McCann 1651 ! 1652 ! 1653 !).—*S. M. Country :* Dharwar (Law).—*Kanara* (Law).

Distribution : Vizagapatam Hills at 3,000 ft.

2. **Eulophia herbacea** Lindl. Gen. & Sp. Orchid. (1833) 182 ; Dalz. & Gibs. Bomb. Fl. 265 ; Hook. f. in F.B.I. vi, 2 ; Cke. ii, 693 ; Fischer Fl. Madras pt. viii (1928) 1435 ; Duthie Ann. Roy. Bot. Gard. ix, t. 106.—*E. brachypetala*

Lindl. in Journ. Linn. Soc. iii, 24.—*Limodorum bicolor* Roxb. Fl. Ind. iii, (1832) 469.—*Eulophia carinata* Grah. Cat. p. 202 (*non* Lindl.)

Distribution : W. Himalaya, Garhwal, 4,000–7,000 ft., Bengal, Rungpore, Gujarat, Konkan, Kanara, Bababudan Hills in Mysore.

3. **Eulophia pratensis** Lindl. in Journ. Linn. Soc. iii (1858) 25 ; Dalz. & Gibs. Bomb. Fl. 264 ; Hook. f. F.B.I. vi, 4 ; Cke. ii, 694 ; Fischer Fl. Madras. pt. viii (1928) 1435.—*E. ramentosa* Wight Ic. t. 1666 (*non* Lindl.)—*E. virens* Grah. Cat. 202 (*non* Brown).

Locality : Gujarat : Panch Mahals (Raoji !).—*Deccan :* Poona (Woodrow 965 !); canal-side, Poona (Herb. Econ. Bot. !) ; Pishan, 6 miles W. of Poona (Tukaram !, Paranjpe !, Gammie !).—*W. Ghats :* Panchgani (A. St. J. Cooke).—*S. M. Country :* Belgaum (Ritchie 1421) ; Dharwar, in grass, 2,400 ft., rainfall 34 in. (Bourne 3481 !); Havasbhavi in Dharwar Dist., in long grass, not common, 2,000 ft., rainfall 33 in. (Sedgwick 2146 !).—*N. Kanara :* Haveri (Talbot 2225 !).—Hook. f. says from the Konkan southwards. We have not seen any specimen from those parts.

Flowers : Nov. 1919 (Dharwar), Dec. 1917 (Dharwar).

Distribution : Deccan, S. M. Country, W. Ghats of Madras Pres.

4. **Eulophia campestris** Wall. Cat. 7617 ; Lindl. Gen. & Sp. Orchid. 185 ; in Journ. Linn. Soc. iii, 24 (*excl. syn.* Wight) ; Hook. f. F. B. I., vi, 4 ; Haines Bot. Bih. & Or. 1171.—*E. ramentacea et rupestris* Lindl. in Wall. Cat 7367, 7368 ; Gen. & Sp. Orchid l.c.—*E. hemileuca* Lindl. in Journ. Linn. Soc. iii, 25.—*Limodorum ramentaceum* Roxb. Hort. Beng. (1814) 69 ; Fl. Ind. iii., 46—*Bletia Dabia* Don Prodr. 30.

Description: A slender orchid. Flowering stem 15–16 cm., rising laterally from the apex of a chain of erect ovoid tubers which are connected at their base (Haines). Sheaths subappressed, acute. Leaves 2, rising from the apex of the slender sheathing pseudostem, developing long after the plant has flowered, 25–40 cm. long, linear, acuminate. Scape sheathed at intervals by loose membranous bracts. Flowers many in lax racemes, sometimes secund or subsecund, or nodding on slender pedicels. Floral bracts variable, membranous, linear or lanceolate, acuminate, usually longer than the slenderly stalked ovary. Sepals slightly attached to the base of the lip, 8–12 mm., linear-lanceolate, or linear-oblong, acute or acuminate, 5–7-nerved. Petals elliptic or broadly oblong, obtuse, or lanceolate, as or nearly as long as the sepals, 5–6 mm. broad, broader than the sepals, 3-5 nerved, greenish or yellowish, with red or brown clouds. Lip 9-11 mm. long, oblong or cuneate-obovate ; side lobes short, rounded or subacute, erect or upcurved, adnate to the column, veined with red, midlobe orbicular, quadrate or oblong, crenulate, purple ? or yellow ?, basal portion of disk with 3 median lamellae, ending in a fimbriate or tubercled patch on the terminal lobe. Spur short or hardly any, obtuse, conical subclavate. Column as long as the lip, slender, without a foot or scarcely any. Pollinia 2, broad, notched and perforated near the base ; caudicle stout ; gland elongate. Capsule 18 mm. long, ellipsoid.

Note.—The various botanical writers do not agree on several details of morphology. Their statements show that the plant is an extremely variable one or that further observations are required on several points. We mention only a few :

Tuber :	' From a deformed tuber.' (Hook. f.).
	' From the last of a chain of erect tubers which are connected at their base.' (Haines).
Colour of flower :	' Flowers yellowish or green with pink or purple markings.'
	' Flowers pale pink with darker lines.' (Brühl).
	' Sepals yellow or green, striped with pink.' (Hook. f.).
	' Sepals and lateral petals green. Lip white, strongly green-veined.' (Hallberg in MS.).
	' Sepals greenish outside, brownish inside.' (Haines).
	' Petals greenish or yellowish with red or brown clouds.' (Haines).
	' Side lobes of lip beautifully veined with red.' (Haines).
	' Midlobe usually purple.' (Hook. f. and Duthie).
	' Midlobe yellow.' (Haines).

Nerves of sepals :	' Sepals 5-nerved.' (Haines). ' Sepals 5-7-nerved.' (Hook. f. and Duthie).
Size of sepals and petals :	' Petals broader than the sepals.' (Haines). ' Petals narrower than the sepals.' (Hook. f. and Duthie).
Shape of petals :	' Petals oblanceolate.' (Hook. f. and Duthie). ' Petals elliptic or broadly oblong.' (Haines). We found them lanceolate.
Ridges on palate of lip :	' 3 median lamellae.' (Hook. f. and Duthie, Brühl). ' 2 crenulate lamellae.' (Haines). Our specimen shows 2 lamellae.

Locality : Konkan : Bombay, Victoria Gardens, wild (Hallberg 15377 !).
Flowers : April in Bombay.
Distribution : Baluchistan, Afghanistan, sub-Himalayan tracts of Rohilkhand and N. Oudh, Nepal, Sikkim (Terai and Duars), Bengal, Chota Nagpur, Chittagong, Upper Burma, Deccan.

5. **Eulophia nuda** Lindl in Wall. Cat. (1828) 7371 : Hook. f. F.B.I. vi, 5 ; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii (1898) 180, t. 243 ; Duthie *eod. l.* ix, pt. ii, 127 ; Prain Beng. Pl. 1016 ; Cke. ii, 695 ; Duthie Fl. Upper Gang. Plain iii, pt. ii (1920) 200 ; Haines Bot. Bih. & Or. 1171 ; Brühl Orchids Sikkim (1926) 109 ; Fischer Fl. Madras viii (1928) 1435 ; Trim. Fl. Ceyl. pt. iv (1898) 177.—*E. bicolor* Dalz. in Kew Journ. Bot. iii (1851) 343 ; Dalz. & Gibs. Bomb. Fl. 264.—*Cyrtopera fusca* Wight Ic. (1852) t. 1690 (*Cke. habet Cyrtoptera per errorem*).—*C. nuda* Reichb. f. in Flora (1872) 274.—*C. mysorensis* Lindl. in Journ. Linn. Soc. iii, 32.
Description : Cke. ii, 694. More complete in Duthie Fl. Upper Gang. Plain iii, 200.
Locality : Konkan : Ambenali at foot of Mahableshwar (Blatter & McCann !).—*S. M. Country :* Ramghat (Ritchie !) ; Amba, Manoli forest (Bhide !) ; Londa (Ahmed Khan 2541 !).—*N. Kanara :* Kalanaddi (Ritchie 708) ; foot of Arbail Ghat, 800 ft. (Sedgwick 6646 !).
Flowers : Jan. 1917 (Londa).
Fruit. Oct. 1919 (N. Kanara).
Distribution : Tropical Himalaya from Nepal to Sikkim, N. Oudh, Chota Nagpur, Assam, Khasia Hills, Manipur, Burma, Pegu, Tenasserim, W. Peninsula, W. Ghats of Madras Pres., 2,000-7,000 ft., Vizagapatam Hills at 3,800 ft., Ceylon.

16. GEODORUM Jackson (Cke. ii, 695).

Species 10.—Indo-Malayan.
One species in the Bombay Pres. We follow Fischer in changing *Geodorum dilatatum* R. Br. into *G. densiflorum* Schlechter.

1. **Geodorum densiflorum** Schlechter in Fedde Report Beih. iv (1919) 259 ; Fischer Fl. Madras. viii (1928) 1437.—*Limodorum densiflorum* Lam. Encycl. iii, 516.—*Geodorum purpureum* Hook. f. F. B. I. vi (1890) 16 ; Dalz & Gibs. Bomb. Fl. 266 ; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii (1898) 181, t. 245 ; Duthie *eod. l.* ix, pt. ii, 130.—*G. dilatatum* R. Br. in Ait. Hort. Kew. ed. 2, v (1813) 207 ; F. B. I. vi, 17 ; Wight Ic. t. 912 ; Prain Beng. Pl. 1017 ; Cke. ii, 695 ; Haines Bot. Bih. & Or. 1170 ; Duthie Fl. Upper Gang. Plain iii, pt. ii (1920) 203.—*Limodorum recurvum* Roxb. Corom. Pl. i (1795) t. 30 ; Fl. Ind. iii (1832) 469.
Description and Locality : Cke. ii, 695.
Distribution : Dehra Dun, Nepal, Sikkim, Bhutan, Assam, Bengal, Andaman Islands, Konkan, N. Kanara, all districts of the Madras Pres. between 200-3,000 ft., Ceylon, China.

17. CYMBIDIUM Swartz (Cke. ii, 696).

Species 30.—Africa to Australia.

1. **Cymbidium aloifolium** Swartz in Nov. Act. Upsal. vi (1799) 73 ; Hook. f. F.B.I. vi, 10 (*partim*) ; Lindl. Gen. & Sp. Orchid. Grah. Cat. 203 ; Dalz. &

Gibs. Bomb. Fl. 266 ; Roxb. Fl. Ind. iii (1832) 458 ; Wight Ic. tt. 1687, 1688 ; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii (1898) 189, t. 252 ; Duthie *eod. l.* ix, pt. 2, 136 ; Fl. Upper Gang. Plain iii, pt. ii (1920) 204 ; Cke. ii, 696 ; Brühl Orchids Sikkim (1926) 115 ; Fischer Fl. Madras, pt. viii (1928) 1436.—*C. bicolor* Hook. f. F. B. I. vi, 11 (*non* Lindl.) ; Trim. Fl. Ceyl. iv (1898) 179.—*Epidendrum pendulum* Roxb. Corom. Pl. t. 44.

Description : Cke. ii, 696.

Locality : Add : *Konkan :* Savantvadi at Tamboli (F. X. Miranda !).

Flowers : May 1903 (Poona, in garden).

Fruit : Jan. (Savantvadi).

Distribution : Sikkim, Bengal, Assam, Andaman Islands, Konkan, Kanara, all hilly tracts of Madras Pres., 100–3,500 ft.

18. SARCOCHILUS Br. (Cke. ii, 697).

Species about 40.—Indo-Malayan, Polynesian.

We retain the 2 species given by Cooke.

1. Racemes shorter than the leaves ... ... 1. *S. viridiflorus.*
2. Racemes much longer than the leaves ... 2. *S. maculatus.*

1. **Sarcochilus viridiflorus** T. Cooke (*non* Hook. f. in F. B. I. vi, 38) ; Cke. ii, 697.—*Saccolabium viridiflorum* Lindl. in Journ. Linn. Soc. iii (1858) 36 ; Hook. f. F. B. I. vi, 63.—*Micropera viridiflora* Dalz. in Kew Journ. Bot. iii (1851) 282.

Description : Cke. l. c.

Locality : Konkan (Dalzell).—*W. Ghats :* Mahableshwar (Cooke !) ; Koina valley below Mahableshwar (Cooke) ; Castle Rock (Bhide !) ; Amboli Ghat (Gammie 15067 !).—*S. M. Country :* Amba (Bhide !).—*N. Kanara :* Usheli (Ritchie 1426) ; Chandwar (Ritchie 1426) ; Tinai Ghat (Bhide !).

Distribution: Endemic in the Bombay Pres.

2. **Sarcochilus maculatus** Benth. in Benth. & Hook. f. Gen. Pl. iii (1883) 575; Cke. ii, 698.—*Saccolabium maculatum* Hook. f. F. B. I. vi (1890) 64.—*Micropera maculata* Dalz. in Kew Journ. Bot. iii (1851) 282 ; Dalz. & Gibs. Bomb. Fl. 263.

Description, etc. : Cke. ii, 698.

Locality : W. Ghats : (Dalzell) ; Phunda Ghat (Ritchie 1427 !).—*N. Kanara :* Idigangi (Bell) ; Kadra (Bell !); Yellapur 1,600 ft. (Sedgwick 5834!).

Flowers : May 1911 (N. Kanara).

Fruit : Aug. 1919 (N. Kanara).

Distribution : Endemic in Bombay Pres.

19. CHILOCHISTA Lindl. (not in Cke.).

Epiphytic herbs ; stem very short, leafless, scaly ; roots slender, long. Racemes erect. Sepals and petals similar, broad, spreading, the lateral sepals inserted on the apical portion of the foot. Petals usually running down the foot. Lip movable on the foot, 3-lobed, spur saccate, side lobes erect, midlobe very short ; disk with a pubescent callus. Column short ; foot broad. Anther 2-celled, pollinia 2, globose, deeply furrowed, caudicle short.

1. **Chilochista glandulosa** *sp. nov.* Blatter & McCann.

[*Orchidacea vicina Chilochistæ pusillæ* Schlechter *sed differet ab ea bracteis ovario aequilongis, pedunculis, pedicellis necnon ovariis densissime glandulis albis conicis coopertis, floribus flavis maculis brunneo-rubris ornatis.*]

Description : A very small epiphytic plant. Roots loosely tufted, tortuose, up to 15 cm. long and about 2 mm. broad, flattened, when fresh white-satiny with a pinkish tinge, running along the underside of branches. Stem 0. Leaves none. Peduncle and raceme about 3–4 cm. long, thin at insertion, thickening upwards, bearing 2–4 flowers, jointed, with a bract at base and at each joint about the same length as the bracts subtending the flower. Peduncles, pedicels and ovaries thickly covered with minute white conical glandular hairs. Racemes about 15 mm. long. Bracts as long as the sessile ovary, 1·5 mm. long, glabrous, veined longitudinally, straw-coloured. Flowers distichous. Sepals yellow, spotted and blotched irregularly and usually densely with brown-red. Dorsal sepal broadly oblong, 5 mm. long, 2·5–3 mm. broad, subobtuse ; lateral sepals broadly oblong, subacute, 3–3·5 mm. long, 2 mm.

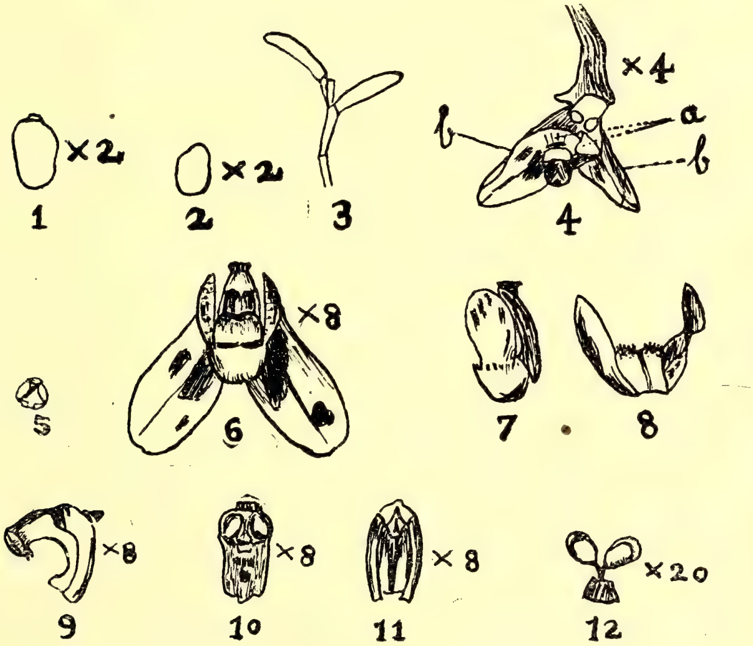
broad. Petals slightly longer than lateral sepals, narrower and subacute at apex, the same colour as the sepals. Lip 3-lobed, 2–3 mm. long, inflexed upon the foot of the column; side lobes more than twice as long as the midlobe, reaching to beyond the inflexed column, then curving towards each other and meeting, even overlapping; midlobe short rounded, slightly emarginate; each little roundish lobe due to the emargination, white-woolly, the woolliness only slightly encroaching upon the upper side of the lip (not visible owing to the inflection of the whole lip). Column very short, scarcely 1 mm. long, somewhat curved, very much bent inwards towards the long foot (about 1 mm. long) to which the lip is joined, white, with the foot purple-blotched. Cap broad, obcordate, yellowish. Rostellum square, transparent, coming away with the gland. Pollinia 2, obovate, slightly compressed, deeply grooved; caudicles short, extensible. The stigmatic surface seems to be a hollow immediately under the rostellum on the front face of the column. Fruit 11 by 2 mm., light green, speckled and blotched with purplish brown, curved thickest in the middle, gradually narrowed into the rhachis, 4-sided, the dorsal and lateral faces slightly ridged down centres, the ventral face broadest with a broad low central longitudinal thickening, the whole surface covered with minute, erect conical whitish glandular hairs. (Most of the description from Bell's MS. prepared from live specimens.)

Locality: N. Kanara: Karwar (T. R. Bell 4969, type); Dandulli (T. R. Bell); Yellapur, on *Careya arborea* and *Randia uliginosa* (T. R. Bell).

Flowers: Jan. 1912 (Yellapur).

Fruit: June (Karwar).

Note: It is useful to remember that Schlechter has united *Chilochista usneoides* Wight Ic. t. 1741 and *Sarcochilus Wightii* Hook. f. under the name of *Chilochista pusilla*.



Chilochista glandulosa sp. nov. Blatter & McCann:

1. Dorsal sepal, × 2. — 2. Lateral sepal, × 2. — 3. Fruit. — 4, a. Side-lobes of lip, × 4. — b. Petals, — 5. Cap. — 6. Flower, × 8. — 7. Attachment of dorsal sepal. — 8. Lip — 9. Side view of column and foot, × 8. — 10. Top view of same, × 8. — 11. Front view of column, × 8. — 12. Pollinia with gland, × 20.

20. RHYNCHOSTYLIS Blume (Cke. ii, 698).

Species 2.—Indo-Malayan.

1. **Rhynchostylis retusa** Blume Bijdr. (1825) 286, t. 49; Hook. f. F.B.I. vi, 32; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii (1898) 213, t. 284; Trim. Fl. Ceyl. iv, 187; Prain Beng. Pl. 1020; Haines Bot. Bih. & Or. 1178; Brühl Orchids Sikkim (1926) 128; Fischer Fl. Madras, pt. viii (1928) 1440; Cke. ii, 698.—*Saccolabium guttatum* Lindl. in Wall. Cat. (1828) 7308; Dalz. & Gibs. Bomb. Fl. 263; Wight Ic. tt. 1745, 1746; Bot. Mag. t. 4108. —*Aerides retusa* Sw. in Schrad. Journ. II (1799) 233; Grah. Cat. 294.—*A. guttatum* Roxb. Fl. Ind. III (1832) 471.—*Epidendrum retusum* Linn. Sp. Pl. (1753) 1351.

Description : Cke. ii, 698.

Locality : Konkan : (Stocks); Salsette (Dalzell & Gibson, Herb. St. X. C. 8691 !); Thana (Ryan 49 !); between Chandal and Karjat (Blatter & Hallberg 26534 !).—*S. M. Country :* Lanze, on Kolhapur-Ratnagiri Road (R. K. Bhide !); W. of Dharwar (Mrs. Wilkinson 4018 !).—*N. Kanara :* Kalanaddi (Ritchie).

Flowers : May 1904 (S. M. Country); June 1918 (W. of Dharwar); July 1918 (Salsette).

Distribution : Tropical Himalaya from the Punjab eastwards to Nepal, Sikkim and Bhutan, up to 4,000 ft, Assam, Khasia Hills, Chota Nagpur, Konkan, Kanara, Deccan, Circars, Walayar, Malabar Coast, Ceylon, Burma, Malay Peninsula, Siam, Java, Philippines.

21. AERIDES Lour. (Cke. ii, 699).

Species about 50.—Eastern Asia.

Cooke mentions 3 species: *A. maculosum*, *A. crispum* and *A. radicosum*. For the latter we substitute the name *A. ringens* Fischer. Key in Cke. l. c.

1. **Aerides maculosum** Lindl. in Bot. Rep. (1845) t. 58; Dalz. & Gibs. Fl. Bomb. 266; Hook. f. F.B.I. vi, 45; Prain Beng. Pl. 1020; Cke. ii, 699; Haines Bot. Bih. & Or. 1182; Fischer Fl. Madras, pt. viii (1928) 1442.—*Saccolabium speciosum* Wight Ic. tt. 1674, 1675.

Description : Cke. ii, 699.

Locality : Konkan : Near Vehar Lake in Salsette.—*W. Ghats :* Lonavla (Garade !); Khandala (Hallberg !); Panchgani (Cooke, Alice Pigott !); Mahableshwar (Cooke !).—*S. M. Country :* Belgaum, west face of Cheeta Hill (Ritchie 713).

Flowers : Jan. 1927 (Salsette); May 1902 (Poona).

Distribution : Chota Nagpur, Konkan, S. M. Country, W. Ghats of Bombay and Madras Pres., up to 4,500 ft.

2. **Aerides crispum** Lindl. in Wall. Cat. (1828) 7319; Dalz & Gibs. Fl. Bomb. 265; Hook. f. F.B.I. vi. 45; Cke. ii, 700; Fischer Fl. Madras. pt. viii, 1442.—*A. Lindleyana* Wight Ic. t. 1677.

Description : Cke. ii, 700.

Locality : Konkan : Between Khandala and Karjat (Herb. St. X. C.!); near Vengurla (Dalzell & Gibson); Wari country (Dalzell & Gibson).—*W. Ghats :* Khandala (Hallberg !); Panchgani (Blatter !); Mahableshwar, very common (Blatter 230 !, M. Ezekiel 26572 !).—*S. M. Country :* Devarayi, S. M. Railway, 1,800 ft. (Sedgwick 4087 bis !).—*N. Kanara :* Yellapur, 1,500 ft., rainfall 100 in. (T. R. Bell 6061 !).

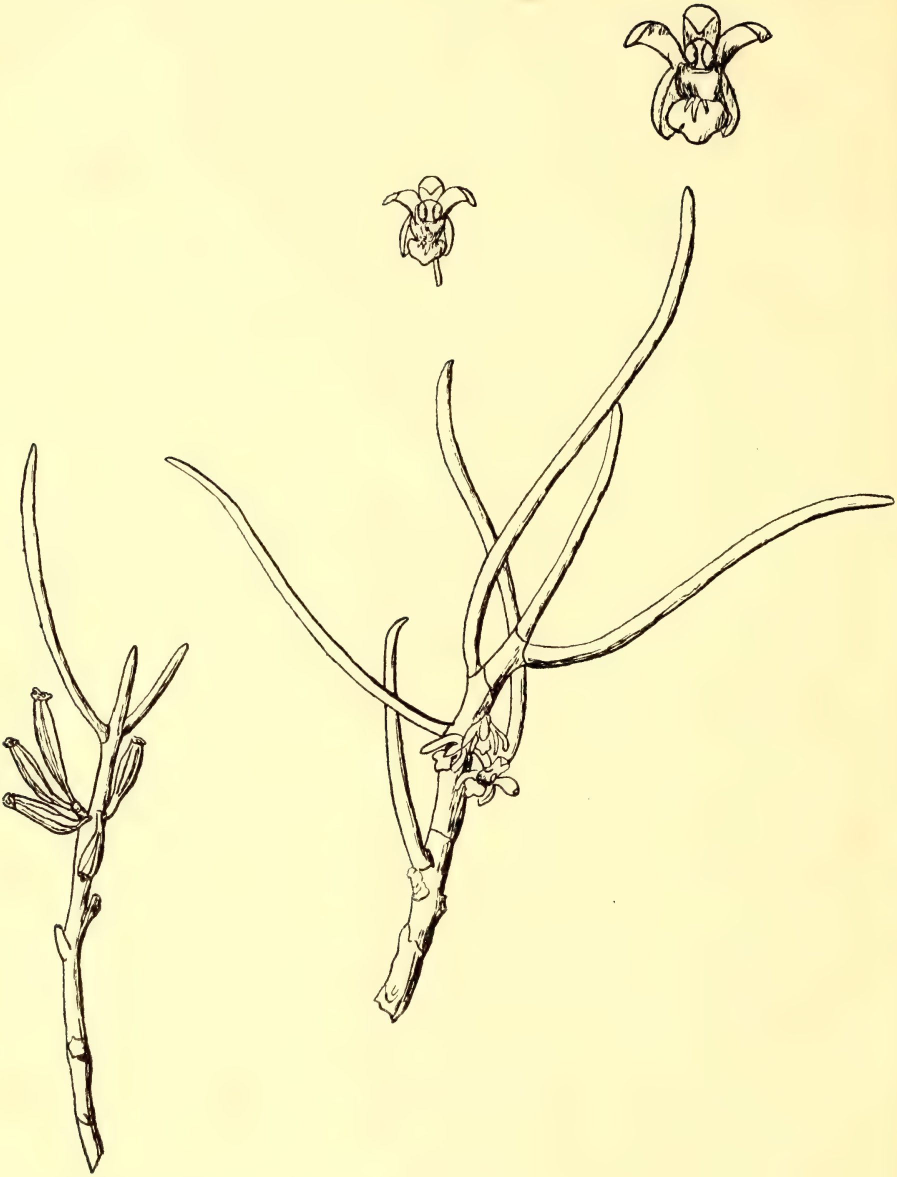
Flowers : May 1903 (Poona); June 1925 (Mahableshwar).

Fruit : March 1917 (Between Khandala and Karjat).

Distribution : Bombay Pres., Nilgiri and Pulney Hills, 3,000-4,000 ft.

3. **Aerides ringens** Fischer Fl. Madras, pt. viii, 1442.—*Saccolabium ringens* Lindl. in Wall. Cat. 7313; Gen. & Sp. Orchid. 220.—*Aerides radicosum* A. Rich. in Ann. Sc. Nat. ser. 2, xv (1841) 65, t. 1, fig. C.; Hook. f. F.B.I. vi, 46; Cke. ii, 700.—*A. lineare* Hook. f. l. c. 47; Trim. Fl. Ceyl. iv (1898) 189.—*Saccolabium lineare* Lindl. in Wall. Cat. 7312.—*S. paniculatum* Wight Ic. t. 1676.—*S. Wightianum* Lindl. in Wall. Cat. 7303; Gen. & Sp. Orchid. 221 (*excl. syn.*); Wight Ic. t. 917.—*S. rubrum* Wight Ic. 1673 (*non* Lindl.).

As *Aerides ringens* Fischer is a combination of 2 species which were considered to be distinct before, we are going to give a description including the characters of *A. radicosum* and *A. lineare*.



Del. C. McCann after Miss E. Bell.

Luisia truncata Blatter and McCann, *sp. nov.*

Description : Stem short, 4-17 cm. long, as thick as the thumb, with very stout simple vermiform roots. Leaves thickly coriaceous, 10-42 by 0·1-2·5 cm.; scymitar-shaped, linear or linear-oblong, unequally 2-lobed at the apex, keeled, often mottled with purple, bases closely imbricating. Flowers from nearly white to deep rose-pink, in simple or branched racemes or panicles shorter or longer than the leaves ; bracts minute, ovate, acute, persistent ; pedicels with ovary 6-16 mm. long. Sepals suborbicular ; lateral sepals 6 mm. long and as broad as long, broadly elliptic or suborbicular ; dorsal sepal 8 by 4 mm., elliptic, obtuse. Petals narrower. Lip 3-lobed ; side lobes very small ; midlobe ovate ; disk with 2 large basal calli ; spur cylindric, obtuse, incurved. Anther beaked ; caudicle of pollinia short, subtriangular ; gland large.

Locality : Konkan : Salsette (Dalzell & Gibson).—*W. Ghats :* Mahableshwar (Woodrow !).—*S. M. Country :* W. of Astoli (Sedgwick 2623 !).—*N. Kanara :* Near Kanapa on the Kalanaddi (Ritchie 715) ; in forests (T. R. Bell 4089 !).—Growing on trees and rocks.

Flowers : July 1917 (S. M. Country).

Distribution : Konkan, S. M. Country, N. Kanara, W. Ghats of Bombay and Madras Pres., 800-8,000 ft., Ceylon.

22. LUISIA Gaud. (Cke. ii, 791).

Species 35.—Tropical Asia to Japan.

Cooke gives 2 species as belonging to the Bombay Pres. We add 4 new species.

Key :

- I. Petals as long as the lateral sepals or only slightly longer
  - 1. Petals linear-oblong, obtuse ... ... 1. *L. teretifolia.*
  - 2. Petals strap-shaped, truncate ... ... 2. *L. truncata.*
- II. Petals much longer than the lateral sepals
  - 1. Leaves not caudate
    - *a.* Leaves rounded at apex .... 3. *L. tenuifolia.*
    - *b.* Leaves sharp-pointed at apex ... 4. *L. pseudotenuifolia.*
    - *c.* Leaves rounded at apex with a short conical apiculus ... ... 5. *L. macrantha.*
  - 2. Leaves long-caudate .... 6. *L. Evangelinae.*

1. **Luisia teretifolia** Gaud. Bot. Freyc. Voy. (1826) 427, t. 37 ; Hook. f. F.B.I. vi, 22 ; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii (1898) 202, t. 271 ; Trim. Fl. Ceyl. iv, 190 ; Prain Beng. Pl. 1018 ; Brühl Orch. Sikkim (1926) 123 ; Fischer Fl. Madras, pt. vi, (1928) 1438.—*Cymbidium triste* Roxb. Hort. Beng. (1814) 63 ; Bot. Mag. t. 3648 ; Wight Ic. t. 911 (*text. tantum*).—*C. tenuifolium* Wight. Ic. t. 1689 (*textu excl.*).

Locality : Konkan : Vettora (Sabnis !).—*S. M. Country :* Devicop (Sedgwick 5786!).—*N. Kanara :* Usheli (Ritchie 1417) ; Wadehukli, 1,500 ft. (T. R. Bell 6078 ! *bis.*), in forests (T. R. Bell 5414 !).

Flowers : May 1919.

Distribution : Sikkim, Khasia Hills, Bengal Pegu, Andamans, Konkan, S. M. Country, N. Kanara, W. Ghats of Madras Pres., 3,000-4,000 ft., Vizagapatam Hills at 4,000 ft., Ceylon.

2. **Luisia truncata** *sp. nov.* Blatter & McCann. [*Orchidacea vicina Luisiae teretifoliae* Gaud. *et L. brachystachyae* Blume, *sed differt ab eis foliis apice apiculatis petalis liguliformibus apice truncatis et epichilio 3-lobulato.*]

Description : Stem stout ; internodes short. Leaves comparatively stout, up to 11 cm. long, spreading, flexuose, uniformly thick throughout, green or greenish, blotched with purple, apiculate at apex. Rhachis a few mm. long, few-flowered (about 3). Flowers small, about 10 mm. wide. Dorsal sepal up to 5 mm. long, a little more than 2 mm. broad, oblong, acute, slightly concave, tip incurved yellowish green outside, greenish purplish inside. Lateral sepals ovate, subacute, boat-shaped, size of dorsal sepal, yellowish green outside, spotted with dingy purple inside. Petals slightly longer than sepals, strap-shaped, truncate at apex, greenish yellow on both sides, spreading, tips bent forward and downwards. Lip in general outline obovate, a little longer than the sepals, about 7 mm., purple, deeply constricted between hypochile and epichile ; hypochile quadrate, concave, a little shorter than the epichile, distal corners rounded ; epichile broadly ovate, broader than hypochile, 3-lobulate, all lobules rounded, central one double the diameter of the lateral ones, a few yellow streaks from the constriction forward. Anther 2-celled. Capsule shortly stalked, about 18 mm. long, 3-4 mm. diam., slightly thicker upwards, but again contracting towards the apex. (Described from detailed coloured illustrations prepared under T. R. Bell's direction by Miss E. Bell.)

Locality : N. Kanara : Yellapur (T. R. Bell).—*W. Ghats :* Castle Rock (T. R. Bell).

Flowers : May 1911.

Fruit : July 1911.

3. **Luisia tenuifolia** Blume Rumph. iv (1848), 50; Dalz. & Gibs. Fl. Bom. 266 ; Hook. f. F.B.I. vi, 24 ; Trim. Fl. Ceyl. iv, 191 ; Fischer Fl. Madras pt. vi (1928) 1438.—*Cymbidium triste* Wight Ic. t. 911 (*ic. tantum*).—*C. tenuifolium* Lindl. Gen. & Sp. Orchid. (1833) 167 ; Grah. Cat. 203.

Locality : Add : *W. Ghats :* Castle Rock (Bhide !).

Distribution : Konkan, N. Kanara, W. Ghats of Bombay Pres., Madras Pres. : W. Ghats, Melpat in S. Arcot, near sea-level to 4,000 ft.

4. **Luisia pseudotenuifolia** *sp. nov.* Blatter & McCann.

[*Orchidacea similis Luisiœ tenuifoliœ* Blume *a qua tamen differt caulis internodiis longis, foliis ad apicem acumine prœditis sepalo laterali apiculato, sepalo dorsali lineari, longitudine petalorum et labii relativa.*]

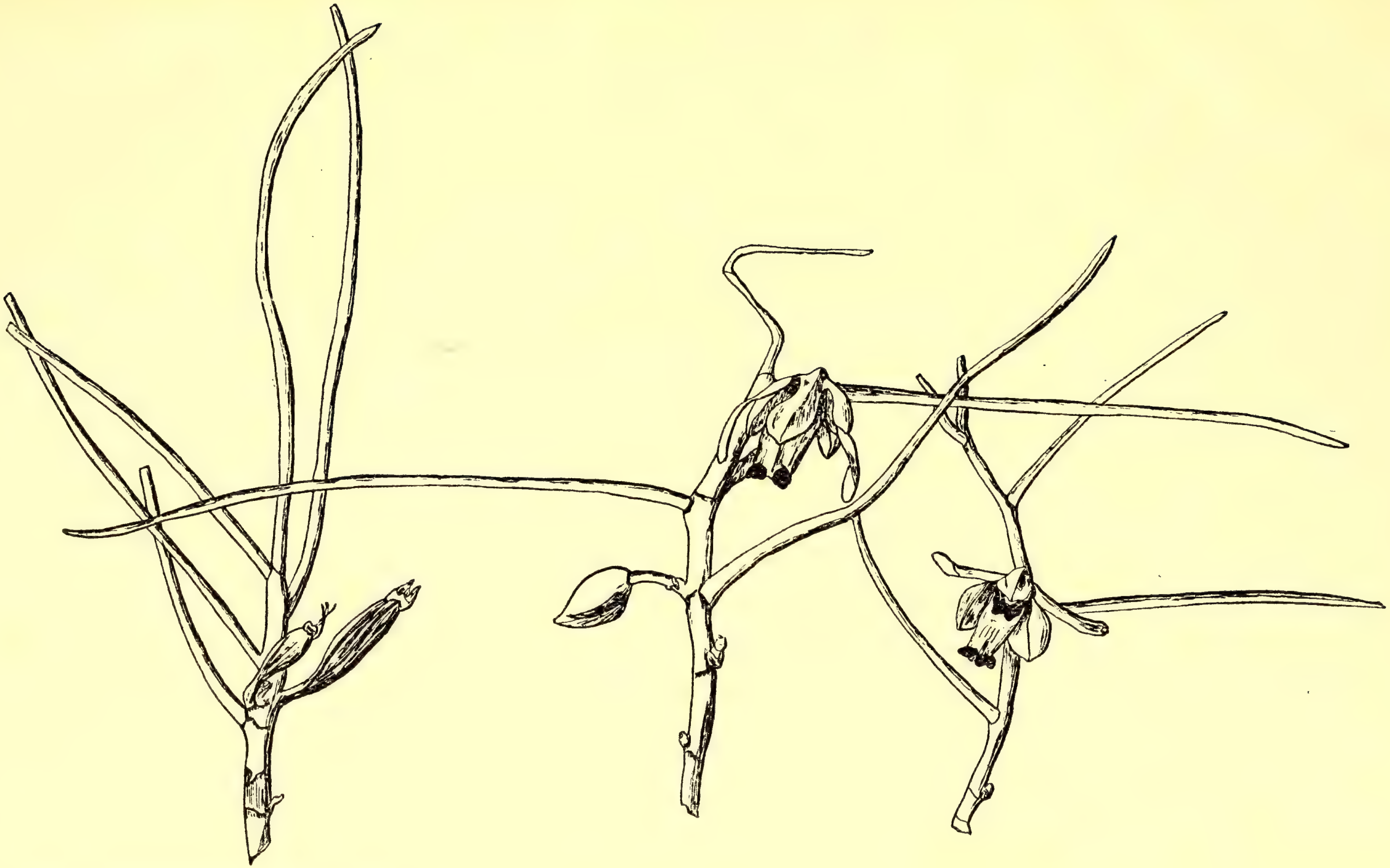
Description : Stem very long, slender ; internodes long, 2–2·5 cm. Leaves up to 20 cm. long, very thin, mostly straight, spreading, forming a knee 2 or 3 cm. from the apex and at the same time becoming much thinner and finally ending in a very thin sharp point. Rhachis of spikes few-flowered, up to 14 mm. long, considerably thinner than the stem. Dorsal sepals linear, rounded at apex, 10 mm. long, 2-3 mm. broad ; lateral sepals ovate-oblong, broadly apiculate, concave, 10 mm. long, 3–4 mm. broad. Petals linear, obtuse at apex, slightly broadening and bent in the upper half, about 20 mm. long, 2–3 mm. broad. Lip narrowly panduriform, 13–14 mm. long, 3–4 mm. broad, with 2 small rounded spreading lobes at the base and 2 short square, diverging lobes at the apex, these lobes about 2 mm. long and over 1 mm. broad. Column stout, much shorter than the lip. Pollinia 2, ovoid. Fruit not seen.

Locality : N. Kanara : In forests (T. R. Bell 5401, type, 5411, cotype).—Found by T. R. Bell in 1907.

5. **Luisia macrantha** *sp. nov.* Blatter & McCann.

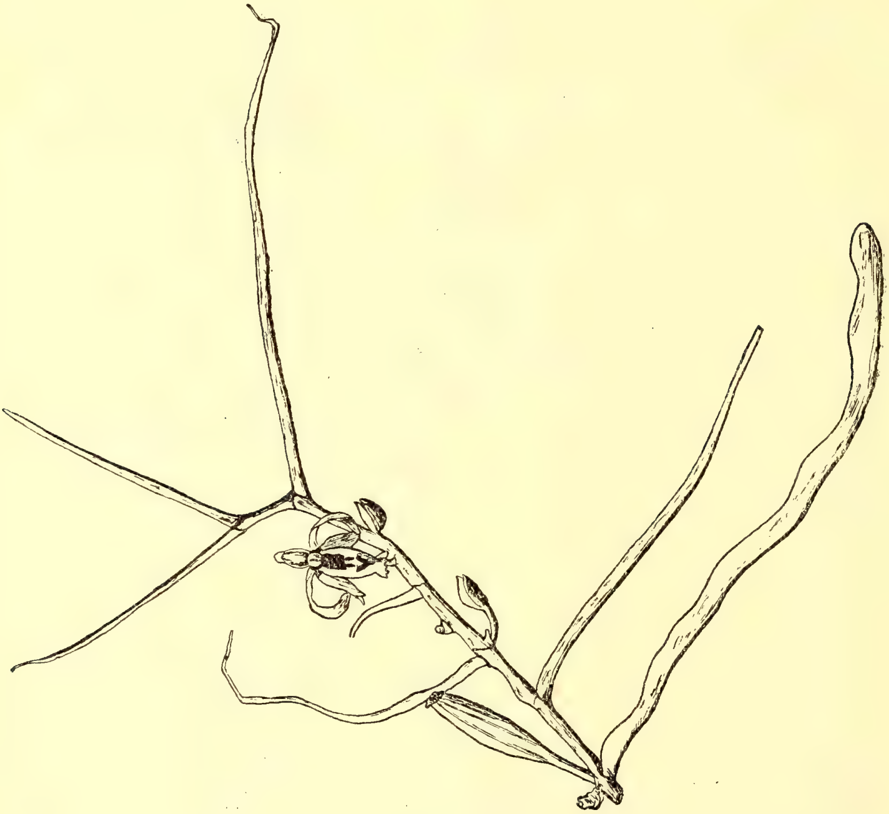
[*Orchidacea ab omnibus aliis Luisiœ speciebus distinguitur florum magnitudine multo maiore, petalis linearibus 4 cm. attingentibus. Differt a Luisia tenuifolia* Gaud. *cui est vicina labio late oblongo, foliis apice conico-apiculatis, partibus omnibus multo maioribus.*]

Description : Stem more than 50 cm. high, stout, almost uniformly so from base to tip, branched or unbranched, dark brown with green shade, branches almost the same thickness as the stem ; internodes 2·5–3·5 cm. long ; roots vermiform, stout, up to 20 cm. long. Leaves up to 20 cm. by 3 mm., cylindrical, variable in thickness, light or dark green, spreading or ascending, straight or flexuose, the tip bluntly rounded with a short conical apiculus at outer side. Buds triangular in section, subobtuse at apex, arising from a woody cylindrical support which is covered with membranous closely appressed brownish grey sheaths, with more opaque, lighter coloured annular edges. Flowers few short in extraaxillary usually 1-flowered spikes reaching with the peduncle about 2·5 cm., very large, measuring in their natural state 3 by 3 cm., when spread out, up to 8 cm. wide and over 6 cm. from the tip of the dorsal sepal to the end of the lip. Sepals equal in size, boat-shaped, 1·6–2·5 by 1–1·5 cm., slightly subemarginate-apiculate at apex, surface shagreened, apple-green, blotched with purplish red, lateral sepals underneath mostly purple-red. Petals long and narrow, linear, pointed obliquely at apex, curved outwards and then inwards, 2·5–4 cm. by 3 mm., apple-green outside and on the distal half of the inside, the basal half of the inside nearly completely purple-red. Lip broadly oblong, slightly dilated before middle, somewhat constricted just before the



Del. C. McCann after Miss E. Bell.

Luisia macrantha Blatter and McCann, *sp. nov.*



Del. C. McCann after Miss E. Bell.

Luisia Evangelinæ Blatter and McCann, *sp. nov.*

endlobes, 2·5–3 cm. long, 5–8 mm. across where broadest, 6 mm. broad at base, endlobes well developed, rounded, diverging; hypochile very broad at base, square, with a small rounded lobe at each basal outer corner, separated from the epichile by an impressed semi-circular curve with the convexity outwards; calli on epichile 3, parallel and close together, the central one triangular in section, high, gradually increasing in height forwards to beyond the middle of its length, then suddenly decreasing to end in the little point separating the endlobes, the lateral calli very much lower, roundly convex in transverse section, slightly higher in centre of their course; endlobes 1·5–3 mm. long. Colour of lip: Apple-green, the calli darker, endlobes very dark purple, hypochile dark purple except its margins which are increasingly apple-green from base forwards, underside apple-green with half its length in centre dark purple-red. Column opaque white, short, semi-circular in transverse section, the front completely hollowed and containing the stigmatic surface, the top slightly concave, the semi-elliptical gland with its 2 sessile anther-lobes separate one from the other but touching, occupying about ½ of the area from front backwards and sideways; length of column about 5 mm., breadth 4 mm. Pollen-masses ovoid, 1 mm. long by less in breadth. Anther-cap squarish with round corners, broadest in front, convex, divided into 2 by a depressed central line, separating the 2 chambers which underneath are partially covered by a membrane; cap white slightly sprinkled purple. Length of twisted ovary 2·2 cm. Capsule 3·5–4 cm. long, spindle-shaped, slightly ridged, rising at an angle of 45°.

This species is a very distinct one. On account of the great size of the flowers and the characteristic shape of the various flower-parts, it cannot easily be confounded with any other species of the genus.

It comes nearest to *L. tenuifolia* but the following points distinguish our species at once: The leaves are not rounded at the apex, but conical-apiculate; the flowers are much larger in all their parts; the sepals resemble each other, all are boat-shaped and the apex is submarginate-apiculate; the lip is not narrowly pandurate but broadly oblong.

Locality: N. Kanara: In forests (T. R. Bell 5397, 5400, type, 5414, cotype); Yellapur (T. R. Bell 5398); Anmod, on *Zizyphus*, alt. 2,000 ft. (Sedgwick 3224!).—We made also use of a coloured plate by Miss E. Bell and MS. notes by T. R. Bell.

Flowers: Nov. 1919 (Yellapur); Dec. 1907 (Anmod).

Note: The plants are not easy to see owing to the leaves looking like stems or twigs and the flower, being always bent with its face to the stem, is most inconspicuous by reason of the green and red colouring.

6. **Luisia Evangelinæ** *sp. nov.* Blatter & McCann.

[*Orchidacea similis Luisiae tenuifoliae, differt tamen foliis apice longe caudatis, sepalis lateralibus subfalcatis, dorsali in dorso subcarinato.*]

Description: Stem long, slender, olive-green above with dark red-brownish spots and blotches. Roots very stout, vermiform, fleshy Leaves up to 18 cm. long, 1–2 mm. in width, long-tailed at apex, tail about 2 cm. long and more or less jointed to rest of leaf, and projecting in a different plane. Buds seen from side triangular, the dorsal sepal flat and convex, broader than the 2 lateral mucronate ones which are keeled in the line of junction and rather prominently winged where they meet the dorsal one. Pedicel half as long as the bud, springing from a short woody support out of a short rounded brown bract; if several arise from one support, the support is just above a leaf, but not necessarily on the opposite side of the stem; base of bud suddenly narrowed into the ovary. Flowers very few, 18 mm. long, 20 mm. broad. Lateral sepals boat-shaped, slightly falcate, 8 by 3 mm. greenish, base red-brown. Dorsal sepal slightly longer, dorsally slightly keeled, obtuse at apex, greenish, base red-brown, spotted with red-brown on back. Petals longer than sepals, narrow, 15 by 1·5 mm.; rounded at apex, upper half apple-green inside, becoming purple towards the base, outside light purplish. Lip panduriform, about 13 mm. long, broad and square at base with 2 small rounded lobes; epichile decreasing in width towards apex, constricted in a wide curve to broaden out again into 2 diverging up-turned lobes 1·5 mm. long; disk with 3 calli, one central rather broad, triangular in transverse section, highest in middle, having its origin at commencement of epichile, running to and between the lobes, the lateral, one on each side, immediately contiguous, somewhat broad, but of uniform height more or less throughout, only on epichile; hypochile smooth, flat. Colour of lip: white with a decided green tinge, hypochile dark purple in the middle throughout its length, each basal lobe with a central dark purple spot; the epichile sometimes with a chevron-shaped mark (the hollow side inwards), this chevron being sometimes reduced to a spot; the purple mark of the hypochile thinly prolonged on each side, sometimes up to the chevron which is, however, always separate, each prolongation sometimes reduced to a spot; the epichile is separated from the hypochile by a semi-circular slightly impressed curve, the purple marking of the hypochile bordered irregularly towards the epichile. Column very short, semi-elliptical in transverse section, the truncation being the front, slightly broader at top. Pollinia 2, ovoid, sessile, divergent from contiguous bases; gland large, deep purple-coloured; cap nearly pure white, the same shape as in *L. tenuifolia*. Capsule spindle-shaped, stalked, ridged, suberect.

Locality: N. Kanara: Astoli and Chandwadi (T. R. Bell, MS. and painting by Miss Evangeline Bell).

Flowers: April 1911.

23. COTTONIA Wight (Cke. ii, 702).

Species 2.—Ceylon to China.

We retain the one species given by Cooke:

1. **Cottonia macrostachya** Wight. Ic. v, pt. 1 (1852) 21, t. 1755; Dalz. & Gibs. Bomb. Fl. 263; Bot. Mag. t. 7099; Hook f. F.B.I. vi, 26; Trim. Fl. Ceyl. iv, 203; Cke. ii, 702; Fischer Fl. Madras, pt. viii, (1928) 1439.

Description: Cke. l. c.

Locality: Konkan (Stocks, Dalzell 4).—*N. Kanara:* Supa (Ritchie 1424.); Yellapur, 2,000 ft. (Sedgwick 2494 bis!); Astoli (T. R. Bell!); without locality (T. R. Bell 6062 bis!).

Flowers: May 1911 (Astoli); May 1917 (Yellapur); June 1919 (N. Kanara).

Fruit: May 1911 (Astoli); May 1917 (Yellapur).

Distribution: Konkan, N. Kanara, Malabar, Anamalais at 2,000 ft., Travancore, Ceylon.

24. VANDA R. Br. (Cke. ii, 703).

Species about 45.—Tropics and subtropics.

Cooke has 2 species: *V. parviflora* Lindl. and *V. Roxburghii* R. Br.; the latter name has to be changed into *V. tessellata* Hook.

1. **Vanda parviflora** Lindl. in Bot. Reg. xxx (1844) Misc. 45; Wight Ic. t. 1669; Hook. f. F. B. I. vi, 50; Trim. Fl. Ceyl. iv, 192; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii (1898) 215, t. 286; Prain Beng. Pl. 1021; Cke. ii, 703; Haines Bot. Bih. & Or. 1181; Brühl Sikkim Orchid. 129; Fischer Fl. Madras pt. viii, (1928) 1444.—*Aerides Wightianum* Lindl. in. Wall. Cat. 7320; Dalz. & Gibs. Bomb. Fl. 265; Wight Ic. v, pt. i (1852) 8.

Locality: Add: *S. M. Country:* Devicop, Dharwar Dist. 1,800 ft. (Sedgwick 5927!).—*N. Kanara:* Yellapur (Sedgwick 2478!); Wadchukli (T. R. Bell!).

Flowers: May 1887 (Poona, cult.); May 1817 (Yellapur); May 1911 (Wadchukli).

Fruit: April 1919 (Devicop); May 1917 (Yellapur); May 1911 (Wadchukli).

Distribution: Kumaon, Nepal, Sikkim, Assam, Burma, Chota Nagpur, Konkan, W. Ghats, S. M. Country, N. Kanara, in all districts of Madras Pres. in hilly tracts, 1000–4,000 ft.

2. **Vanda tessellata** Hook. ex G. Don in Lond. Hort. Brit. 372; Fischer Fl. Madras pt. viii (1928) 1445; Haines Bot. Bih. & Or. 1181.—*Epidendrum tessellatum* Roxb. Corom. Pl. t. 42.—*Cymbidium tessellatum* Swartz in Nov. Act. Upsal. vi, 75; Roxb. Fl. Ind. iii (1832) 463.—*C. tesselloides* Roxb. Fl. Ind. l.c.—*Aerides tessellatum* Wight in Wall Cat. 7318.—*Vanda tesselloides* Reichb. f. Walp. Ann. vi, 864.—*V. Roxburghii* R. Br. in Bot. Reg. vi (1820) t. 506; Wight Ic. t. 916; Hook. f. F. B. I. vi. 52; Trim. Fl. Ceyl. iv, 192; Duthie Ann. Roy. Bot. Gard. Calc. ix, t. 116; Prain Beng. Pl. 1021; Cke. ii, 704.

Locality: Gujarat: Chikli (Gibson).—*Konkan* (Woodrow!).—*N. Kanara:* Kalanuddi (Ritchie 1425); Astoli (Bell!); in forests (Bell 5399!).

Flowers : April 1911 (Astoli).
Fruit : April 1911 (Astoli).
Distribution : Forests of Dehra Dun and in the sub-Himalayan tracts of Rohilkhand and N. Oudh, Bengal, Bihar, Chota Nagpur, Central Prov., Gujarat, Konkan, N. Kanara, in all districts of Madras Pres., about sea-level to 2,000 ft., Travancore, Ceylon.

25. DIPLOCENTRUM Lindl. (Cke. ii, 704).

Species 2.—India.

1. **Diplocentrum congestum** Wight Ic. v, pt. 1 (1852) 10, t. 1682; Hook. f. F.B.I. vi, 78; Rolfe in Hook. Ic. Pl. xxvii (1901) t. 2687; Cke. ii, 704; Fischer Fl. Madras, pt. viii (1828) 1449.
Locality : W. Ghats : Castle Rock (T. R. Bell 7505 !).—*N. Kanara :* Sirsi-Kumpta road (Woodrow !).
Flowers and fruit : May 1920 (Castle Rock).
Distribution : N. Kanara, W. Ghats of Bombay and Madras Pres., Travancore.

26. ACAMPE Lindl. (Cke. ii, 705).

Species about 15.—East Africa, Madagascar, India, Malacca, China.
There is only one species in Cooke : *A. Wightiana* Lindl. We change its name into *A. præmorsa*.

1. **Acampe præmorsa** *nov. comb.* Blatter & McCann.—*Epidendrum præmorsum* Roxb. Corom. Pl. t. 43.—*Cymbidium præmorsum* Swartz in Nov. Act. Upsal. vi, 75; Roxb. Fl. Ind. iii (1832) 465.—*Aerides praemorsum* Grah. Cat. 204 (*non* Willd.).—*Saccolabium præmorsum* Hook. f. F.B.I. vi (1890) 62; Prain Beng. Pl. 1022; Haines Bot. Bih. & Or. 1180.—*Acampe Wightiana* Lindl. Fol. Orchid. (1853) 2; Cke. ii, 705; Fischer Fl. Madras, pt. viii (1828) 1447.—*A. excavata* Lindl. Fol. Orchid. l. c. 3.—*Saccolabium Wightianum* Hook. f. F. B. I. vi (1890) 62; Trim. Fl. Ceyl. iv, 199; Petch in Ann. Roy. Bot. Gard. Peradeniya 7 (1920) 79-83.—*Vanda Wightiana* Lindl. ex Wight Ic. v, pt. 1 (1852) 9, t. 1670.—*Saccolabium papillosum* Dalz. & Gibs. Bom. Fl. (1861) 264 (*non* Lindl.).
Description : Cke. ii, 705.
Locality : Konkan : Kanheri, Thana Dist. (Gamme 16273 !); Thana Dist. (Ryan 5 ! Herb. Calc.); Bhandup (Blatter 25820 !); Condita, Salsette (Blatter 25816 !); Sion (Blatter 15371 !); Indapur (Graham).—*S. M. Country:* Belgaum (Ritchie 716); Devicop (Sedgwick 4084 !).—*N. Kanara :* Dandeli (Sedgwick 2546 !); in forests (Bell 5398 !).
Flowers : May.
Fruit : July.
Distribution : Bengal, Chota Nagpur, Bombay Pres., W. Ghats of Madras Pres., Circars, Godavari Dist., Ceylon.

27. SARCANTHUS Lindl. (Cke. ii, 706).

Species about 90.—Ceylon, India to New Guinea.
Only one species from the Presidency, *S. peninsularis* (called by Cooke *peduncularis* by mistake).

1. **Sarcanthus peninsularis** Dalz. in Hook. Kew Journ. Bot. iii (1851) 343; Dalz & Gibs. Bomb. Fl. 264; Hook. f. F.B.I. vi, 67; Trim. Fl. Ceyl. iv, 200; Fischer Fl. Madras, pt. viii (1928) 1447; Rolfe in Kew Bull. (1914) 71.—*S. pauciflorus* Wight Ic. (1852) t. 1747.—*Saccolabium acuminatum* Thw. Enum. Pl. Ceyl. (1861) 304.
Description : Cke. ii, 706.
Locality : Konkan : (Stocks 35); Wari country (Dalzell).—*N. Kanara :* Kalanaddi (Ritchie 430); Arbail Ghat, 1,550 ft. (Sedgwick 5836 bis !); Yellapur, 1,500 ft. (T. R. Bell 7870 !); Anshi (T. R. Bell !).
Flowers : May (Anshi).
Fruit : Aug. 1919 (Arbail Ghat).
Distribution : Konkan, N. Kanara, W. Ghats of Madras Pres., Travancore, Ceylon.

(*To be continued.*)

A FEW NOTES ON PERSIAN, AFRICAN AND INDIAN LIONS IN THE FIRST CENTURY AFTER CHRIST.

Read on Wednesday the 15th July, 1931 before the Bombay Natural History Society.

BY

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I

INTRODUCTION.

The subject of this Paper is suggested by an interesting article, entitled 'The Lions of Asia' by Mr. R. I. Pocock, in a recent issue of the *Journal of the Bombay Natural History Society* (vol. xxxiv, No. 3, pp. 638 ff.). It is the general account of the lions, and not the too technical, that has interested me. The object of this brief paper is two-fold:

(1) To submit a few observations on the subject of the lions from an old Iranian or Persian point of view.

(2) To submit a few notes on the lions of Persia, Africa and India, as collected from an account of the travels of a Greek ascetic or *sâdhû*, Apollonius of Tyana, as given by Philostratus the Elder, on the authority of the Notes of Damis, a disciple of Apollonius, who accompanied the Greek *sâdhû* in his travels in the countries of the Iranian Magi and the Indian Brahmins. In these few Notes, as regards my account of the observations of Apollonius, I follow a recent publication of the biography of Apollonius, entitled, 'Life and Times of Apollonius of Tyana, rendered into English from the Greek of Philostratus the Elder', by Charles P. Eells (1923). I will, at first, say a few words on Apollonius and his travels.

II

APOLLONIUS OF TYANA.

Apollonius, who is said to have lived for 100 years, was born about three years before Christ in Tyana, a city of the Greeks which was the capital of Cappadocia in Asia Minor. He was a follower of the philosophy of Pythagoras (d. 500 B.C.), who himself was said to have been a disciple of Zoroaster, i.e., a follower, to some extent, of the teachings of Zoroaster.[1] From his very boyhood, he devoted himself to the study of philosophy and practised austerities. He is said to have observed complete silence for five years in order to discipline his mind. Like Gautama Buddha of India, he distributed his patrimony among the poor, abstained from the company of women, observed vegetarianism and total abstinence from wine. He is said to have predicted future events, read the minds of men, and known what happened in foreign lands. Like the ancient Iranians and like some of their descendants, the modern Parsees, he prayed to God, reverencing the Sun thrice a day, offering incense to the deities, who, he believed, were 'merely phases and agencies of the Supreme Deity.' Like Iarchus, the Indian sage, with whom he had long interviews, he compared the universe to a ship, God to its captain and the subordinate deities to the subordinate officers under the captain. He believed in metapsychosis. He travelled a good deal from the Atlantic in the west *via* Persia, to the Ganges in the East, returning to his country, *via* the Persian Gulf and Babylon. He went to the south in Egypt up to the Cataracts of the River Nile. He is said to have worked some miracles like Christ and some Indian Brahmins. He was honoured as a god after his death, and, to some extent, even in his life. After his death, the Emperor Hadrian founded at Tyana a temple in his honour and instituted a special class of priests for worship in that temple. Alexander Severus, another Roman Emperor, is said to have installed in his 'private chapel or *lararium*' his image, 'in company with Orpheus, Abraham and Christ'.[1] It was Juslia Domna, the queen of the Emperor Septimius Severus, who deputed Philostratus to write a life of Apollonius on the authority of the Notes of Damis, spoken of as 'the Asiatic Boswell of Apollonius' [2], that were preserved, and on that of some other materials which she had collected. Sometime after this, Hierocles, a Roman pro-consul of the Emperor Diocletian, in his book *Candid Words to Christians*, in order to set back 'the rising tide of Christianity and in his zeal of comparing and extolling him, showed Apollonius in a better light than Christ.' The followers of the nascent Church, thereupon, began turning the tide upon the fame of Apollonius and represented him as a charlatan, sorcerer, etc. This turning of the tide seems to have continued since, especially with the advancement of new learning.

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[1] Pythagoras and the Delphian Mysteries, by Ed. Schure, translated by F. Ruthwell (1918), p. 27.

Some of the feats, attributed to Apollonius, remind us of the feats of some eastern adepts, e.g. Âzar Kaivân of Istakhar or Perseipolis in Persia, who also is said to have travelled to India, in the time of Akbar with a number of disciples and stayed in Patna, the seat of pilgrimage of Buddhist, Brahmin and Jain devotees.

III

THE LION IN OLD PERSIAN LITERATURE.

Mr. Pocock says: 'It is a matter of common knowledge that within historic times the lion extended, so far as Europe and Asia are concerned, from northern Greece and Macedonia to western

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[1] Life and Times of Apollonius *op. cit.*, Preface p. 4.
[2] *Ibid*, p. 6.

Bengal. In Europe, Asia Minor and Syria it has long been extinct.' (p. 641). This statement has led me to look into old Persian books, to know what is said about lions in those books.

Lion not mentioned in the Avesta Books

Looking to the older Iranian writings of the Avesta, we find mention made of ferocious beings like the wolf and snakes, but no mention is made of lions and tigers. So, we may safely say, that lions and tigers were not found in the countries where the Avesta was written. There is a difference of opinion as to the Home of the Avesta, i.e., as to where the Avesta was written. Scholars like Dr. Spiegel, Prof. Harlez and Dr. Dillon[1] said that the Avesta was (*a*) co-Achæmenian or post-Achæmenian and (*b*) that its Home was in the West in or towards Media. On the other hand, Prof. Geiger and other Oriental scholars say that the Avesta was pre-Achæmenian and pre-Median, and that its home was in the East towards Bactria, and not in the West towards Media. Most of them say that the Home of Zoroaster was in the West towards Media, but that he promulgated his religion and wrote the Avesta in Bactria.

Thus, as the Home of the Avesta was in the east of Persia, in Bactria, and as we find no mention of the lion in the Avesta, we are led to think that the lion did not flourish there. The Home of the Pahlavi writings was west-ward. So, when we find a reference to the lion in Pahlavi books written in a comparatively western part of ancient Persia, we are led to think that the lion flourished there, i.e., in the western part of the Persian Empire, e.g., in Mesopotamia.

Mr. Pocock's Association of the Lion with Tigers and Panthers. The same in a Pahlavi Book.

Mr. Pocock associates the lions with tigers and panthers in one genus, the genus *Panthera* and speaks of the three as ' these great Cats '.[2] When we look to a very earlier Pahlavi book, the Bundehesh (the origin *bûn* of Creation, *dehesh*, the Iranian Genesis), we find there some account of the fauna and flora of ancient Persia, but therein we do not find any mention of the lion. This book has its origin in a lost Avesta book, known as the Dâmdâd nusk[3]. So, as the lion was not known in the country where Avesta was written, i.e., in and about Bactria, we do not find any mention of the lion in this old Pahlavi book also, because it was based on a lost Avesta book. But we find[4] the lion referred to in some later Pahlavi books.[5]

(*a*) Firstly, it is mentioned in the later Bundehesh, known as the Greater Bundehesh, which, as I have shown in my Bundehesh,[6] is a later amplification of the original old Bundehesh. There we read that the tiger, the lion and the panther are mentioned in the class of wolves. We read : '*Âkhar avârik gûrg sardagân chegûn baparg va shêr va palang.*' i. e. 'The other kinds of wolf like the tiger,[1] the lion[2] and the leopard.[3]'

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[1] *The Home and Age of the Avesta* translated from the German by Mr. T. H. Walsh, Bombay, 1887.

[2] *Jour. Nat. His. Society*, op. cit., p. 638.

[3] Vide my Transliteration and Translation of the Bundehesh, p. 10.

[4] I am indebted to Mr. Bomanji N. Dhabhar for some of these references.

[5] The Bundahishn, edited by the late Ervad Tehmuras Dinshaji Anklesaria (1908), p. 147, l. 13.

[6] *Ibid*, pp. 19 ff.

We find from this passage that, like Mr. Pocock, the writer of this later Bundehesh associates the tiger, the lion and the leopard in one group and he speaks of them, as it were, as 'the great Wolves.'

(*b*) *Lion in the Pahlavi Shikand Gumanik Vijâr.*

The lion is referred to in the Shikand Gumanik Vijâr as a ferocious animal from whom a man is to be afraid. In this respect, he is classed[4] with wolves, (ferocious) dogs, and robbers (*shîr va gurgân va kalban va dûydan*). The lion is referred to again in this book as killing men at times and as being killed by men at other times.[5] '*Âigham khaditûnt mardi mûnash sher i âyûp sheri munash mardi bara zaktalunt,*' i.e., 'I saw a man whom a lion killed or a lion whom a man killed.'

Lion referred to in a Pahlavi Pand-nameh.

We find a reference to the lion in the Pahlavi 'Pand-nameh-i-Adarbad Maraspand' i.e. the *Book of Advice* by Adarbad Maraspand who was a divine of the reign of Hormuz Shapur, the grandson of Ardeshir Babegan. There we read : '*Dayan abû va am i nephshman tarskâs va niyokshidâr va farmân-bardâr yehvûnit meman gabrâ vad abû va am i zivandeh avin humanâk chegûn shîr amat dayan visheh min aîshîch sîah la tarcet*' i.e. 'Be respectful, careful to hear and obedient to your father and mother, because a man during the life time of his father and mother is like a lion that is afraid of none in a forest.' Here we find a reference to a lion as the bravest of all animals.

Derivation of the word 'Shir'

The Pahlavi and Persian word '*Shir*' for lion is derived by Darmesteter from Avesta *khshathrya*, king (*cf.* Pahl. Artakhshathra, Pers. Ardashir)[6]. Darmesteter gives this derivation, while giving an account of the process of epenthesis, but does not explain the word. The lion is said to be the king of animals. Hence, this derivation. This derivation is supported by what we read in '*Pythagoras and the Delphian Mysteries*, by Ed. Schurè.'[7] We read : 'In their temples darkness reigned in broad daylight. Lamps were lit without human agency. The Magi gave the name of celestial lion to this incorporeal fire, the agent that generates electricity which they could condense or disperse at will.' We know, that Parsee writings speak of the sacred fire of the Fire-temple as *shâh* or king. As a king rules over, and protects, a country or city, so, the Sacred Fire of a Temple rules spiritually over a country or city where it is situated and protects it. This sacred fire which is spoken of as a king was, as told by this author, called 'celestial lion.' Hence the derivation of the word *shîr* (lion) from *khshathrya*, king, seems to be probable.

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[1] P. ببر or ببر بیان *babr* or *babr-i biyân.*

[2] P. شیر *shêr.*

[3] P. پلنگ *palang.*

[4] Chap. iii, 34, 37 S. B. E., vol. xxiv, p. 127. The text of Drs. Hoshang and West (1887), p. 193, l. 7.

[5] *Ibid.* chap. v, 32, Text, p. 209, l. 7.

[6] *Études Iranniennes*, vol. i, p. 106.

[7] Ed. Schure's work Translated by F. Rathwell (1918), p. 27.

IV

THE LION REFERRED TO IN THE ACCOUNT OF APOLLONIUS'S TRAVELS IN PERSIA.

Now, I will speak of what is said of the lion in Philostratus's account of Apollonius's travels in Persia and India.

Lions in Mesopotamia, the Western part of the Persian Empire

Mesopotamia formed a part of the Persian Empire at the time when Apollonius passed through it towards India. We read about his travels in this region, that, after passing Ctesiphon and entering the territory of Babylon, he met the Persian King Verdanes.[1] In the account of Apollonius's approach before Verdanes, we read : 'About twenty stadia further on, they came upon the largest lioness they had ever seen, which had just been killed by a party of hunters from a nearby village, who were shouting over it as a great curiosity. It certainly proved to be so, for when ripped open it was found to contain eight cubs. Now the normal period of gestation in lionesses is six months, and each lioness produces only three litters in her life, having three cubs in the first litter, two in the second and only one cub in the third, which is said to be unusually large and fierce. No credence should be given to the fable that young lions gnaw their way out of the womb through their mother's body, for the natural instinct to preserve the race is common to all parents and their offspring.' After silently observing the beast for some time, Apollonius said to Damis: 'We shall spend one year and eight months of our pilgrimage with the king of this country, for he will not let us go sooner; and besides it will be for our advantage to make that stay. The cubs stand for the eight months and the lioness for the year as perfect things are to be compared with perfect.'[2] The stay of Apollonius in the court of the Persian king, lasted 18 months as predicted by Apollonius.

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[1] This Verdanes was the Parthian King, known in his country as Behram Goudarz. This Gudurz is the Gutarzes of Western writers. He was the third king of the second Arsacide dynasty. He is said to have punished the Israelites for having killed John the Baptist (Malcolm's *History of Persia*, vol. i, p. 66). Vide *Encyclopædia Brit.*, 9th ed., vol. xviii, p. 601.

[2] Life of Apollonius, op. cit., p. 22.

We gather the following facts about the lion from Philostratus's account of Apollonius's visit of Mesopotamia:

1. An extraordinary big lioness had eight cubs in her womb.
2. The normal period of gestation in lionesses is six months.
3. Each lioness produces only 3 litters in her life. She has three cubs in the first litter, two in the second and one in the third. This last one is unusually large and fierce.
4. There was a belief at the time that young lions gnawed their way out of the womb through their mother's body. But that was a wrong belief.
5. People took some predictions from animals like the lions.

An Iranian King's Hunt of Lions at Babylon.

From Apollonius's account of the Iranian king's hunt at Babylon, we gather the following:

(*a*) The Iranian kings had a preserve at Babylon where lions, bears and leopards were kept for their hunt.

(*b*) The king used beaters who harassed the beasts, and fenced them in 'so that they cannot protect themselves in their own way.' [1] We learn from this statement that the modern Indian practice of kings (*a*) to have their own preserves and (*b*) to take the help of beaters in the hunt, is very old, more than about 2,000 years old. As to what is said about harassing the lions, etc., and forcing them into an enclosed fence and then hunting them, that does not seem to be now practised in India. I had the pleasure of seeing in December 1924, through the courtesy of the present Maharaja of Oodepur—'the Kashmir of Rajputana'—who was then a prince, a tiger-hunt and I saw that there was no forcing the animals within a fence.

Lions in the country round Taxala, in the Eastern part of the Persian Empire.

At the time of Apollonius's visit to India, Taxala and the country round about it formed the eastern part of the Persian Empire. It was ruled over by Phraotes [2], a Parthian king. Apollonius had an interview with that king and he speaks thus about the order of Phraotes to his lion-tamers: 'They must never strike the lions, because lions once beaten never forget the injury; nor must they pat them, because they would become spoiled; but they could make them docile by stroking them softly and showing the whip at the same time.' Apollonius thought this instruction about curbing the lion to be equally useful for curbing tyrants.[3] In this connection, we find a reference to Æsop's lion. Damis says to Apollonius: 'Æsop tells of another lion, in a den, who, he says, was not really ill though he pretended to be, and who used to pounce on any beasts which came to see him.'

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[1] *Ibid*, Bk. i, 38. Life of Apollonius op. cit., p. 33.

[2] This Phraotes seems to be Phraotes V (Vide *Encyclopædia Britannica*, 9th ed., vol. 18, p. 600, col. 2.)

[3] Bk. vii, 30. The Life of Apollonius, op. cit., p. 204,

V.

AFRICAN LIONS.

We find two references to the lions of Africa: (*a*) A reference to the lions of Egypt and (*b*) A reference to the lions of Ethiopia (modern Abyssinia).

The Story of an African Lion: Its Metampsychosis.

In this account of Apollonius's visit, we find the story of an African lion associated with the belief in metampsychosis. We read: 'A beggar was leading a lion about in a leash like a dog,[1] which fawned on its master and on any one else who came near. They begged their way about the towns, and even went into the temples, as the animal was pure and did not lick up the blood of victims, nor try to get at their skinned and cut up carcasses, contenting himself with honey-cakes, and rolls, and sweetmeats and cooked flesh. He would even drink wine at times, without being affected by it. Apollonius being seated in a temple, this lion came up to him and gently rubbed against his knees, soliciting him alone, of all the men there'.[1] Some thought that he was begging money, but Apollonius said, 'He is begging me to tell you whose soul he has. He was that Amasis who was a king of Egypt in the Saitic Province. On hearing that, the lion howled mournfully and groaned pitifully, crouching and actually shedding tears.' Then Apollonius said, patting him: 'I think this lion should be sent to Leontopolis and be kept in the temple there. I do not think it right that a king, who has been metamorphosed into an especially royal beast, should wander about as a beggar. Thereupon the assembled priests made sacrifice for Amasis and sent the animal into Egypt adorned with a collar and fillets, while they played on flutes and chanted hymns and songs about him.' [2]

Lions of Ethiopia.

We read the following about Ethiopian lions in the life of Apollonius: 'They saw lions and leopards and beasts of that description near the trail, which did not molest the party, but got out of their way as if afraid of man. They also saw deer, gazelles, ostriches, zebras in great numbers, and still more numerous wild cattle (buffaloes ?) and ox-goats (gnus ?). Of these animals the wild cattle are a combination of the bull and the stag; and the ox-goats are a compound of the animals whose names they bear. The party often came across bones of these beasts, and their half-eaten carcasses; for lions, after gorging themselves with a recent kill, would abandon the remnants, trusting to the success of their next hunt, as I suppose.' [3]

VI.

LIONS IN INDIA.

We find several references to Indian lions in Philostratus's account of Apollonius's visit of India.

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[1] We observe even now, practices of this kind in India, wherein beggars lead about animals like a cow, a goat, a bear, etc., and ask for alms.

[2] *Ibid*, Bk. v, 42, p. 146.

[3] Bk. vi, 24. Life of Apollonius, op. cit., p. 172.

Lions abounding in India.

From the account of the return of Apollonius from India, where he lived for about four months in a hill-town, we learn, that on approaching the Erythræan Sea,[1] he passed through a country abounding with 'many ostriches and buffaloes, many asses and lions and leopards and tigers, and a different kind of ape from those found in the pepper-trees, these being black and bristly, shaped like a dog and about as large as a small man.'[2]

(*a*) *Lions and Apes as enemies in India.* *Indians protect Apes.*

In the account of Apollonius's visit to India, we find a curious instance of how apes help men, and so, are helped in return by men against lions. In one mountainous place there grew pepper-trees in abundance 'in precipitous rocks inaccessible to men.' The apes thus helped men in collecting pepper from the trees on these inaccessible cliffs. 'The native method of procuring the pepper is to gather the berries from the few trees which grow below the cliffs, wherever they can be reached, and then to clean a space about each tree, on which they fling the berries down as if getting rid of a useless thing to which they attach no value. Meantime the apes are watching these proceedings from the inaccessible cliffs, and when night comes they imitate these actions of the natives by plucking the berries from their own pepper-trees in high glee and throwing them down on the places cleared by the men. Next day the Indians come and take away those piles of spices, which have been gathered without any labour of their own, while they were asleep at their ease.'[3]

Now, Philostratus, the biographer of Apollonius, says that the lions in this part of the country[4] killed the apes for their food. So, the natives defended the apes 'from lions with dogs and weapons'[5] and killed the lions.

(*b*) *Lionesses breeding with Leopards.*

Mr. Pocock, in his above-mentioned article, thus speaks about spotted lions: 'It is well-known that newly-born lion cubs are not uniformly tawny in hue like the adults; and it was stated by Lydekker (*Game Animals of India*, p. 293, 1924) that their spotted pattern proves the descent of the lion from a spotted progenitor, like the panther. Unfortunately for this theory lion cubs are by no means always spotted.'[6] Then, referring to a certain lion cub Mr. Pocock says: 'If we take this cub as a criterion, it appears to supply evidence that the ancestor of the lion in the matter of pattern stood midway between the panther and jagaur on the one hand and the tiger on the other; and this pattern is strong corroborative testimony of the close kinship between lions, tigers and panthers.'[1] This view, that, in some cases, lion cubs are the offspring of the lionesses' union with tigers, is supported by what we read in the account of Apollonius's, visit to India: 'It is said of lionesses that they accept leopards, as their lovers, and entertain them in the lions' lairs in the plains'[2], (*b*) that 'when their pregnancy (by the leopards) is nearly over they run away to the hills where the leopards range'[3], (*c*) that 'the cubs they bring forth are spotted like their sires (i.e. the leopards)'[4], and (*d*) that 'for that reason the lionesses hide them from the lions and suckle them in distant thickets, pretending to go there to hunt by themselves; for any such cubs which the lions discover they tear to pieces as bastards.'[5] Apollonius, in his conversation with Damis, refers to one of Homer's lions, which 'glares fiercely about and nerves himself to fight for his litter of cubs.'[6]

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[1] 'The whole expanse of sea between Arabia and Africa.'

[2] *Ibid*, Bk. iii, 50, p. 89.

[3] *Ibid*, Bk. iii, 4, pp. 35-66.

[4] The country is spoken of as 'the range of the Caucasus which extends towards the Erythrean Seas.' This seems to be the Hindukoosh.

[5] *Ibid*, Bk. iii, 4, p. 65.

[6] *Jour. Nat. His. Society*, vol. xxxiv, No. 3, p. 639.

Flesh of Lion eaten by Indians.[7]

When Apollonius came to a region between the Caucasus and the Kophen river, he came across a people who ate the flesh of lions. We read: The nomads 'raised a joyful shout and called them nearer, and on their approach held out to them a wine which they make very skilfully from dates, and honey obtained from the same trees, together with slices of lion and leopard meat which had just been skinned.'[8] We read further on that, at times, lions were cooked and 'served up whole.'[9] The account of the feasting of the eastern Iranians on lions, etc., is interesting, and so, I will quote it at some length: 'The king reclines on a couch, and near him recline not more than five of his kindred, but all the other guests sit during the meal. A circular table is set in the midst, which is about knee-high, like an altar, of a size which thirty men could encircle by taking hands like a chorus. On this table are scattered laurel leaves, and another leaf like myrtle, which the Indians use as perfume. Fish and fowl are set on it, with lions, antelopes and swine, served up whole: but only the hind quarters of tigers, for they are unwilling to eat the rest of that animal, because they say that as soon as it is born, it lifts its fore-paws to the rising sun. Each guest rising in turn goes from his seat to the table and selects or carves for himself his portion of the dishes set on it, which he brings back to his place and eats there,[10] accompanying it with a great deal of bread. When all have enough to eat, gold and silver bowls are passed around to them, one for every ten guests, from which they drink, stooping their heads to it like sheep at a trough.'[11]

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[1] *Ibid.* [2] *Ibid*, Bk. ii, 14, p. 45. [3] *Ibid.* [4] *Ibid.* [5] *Ibid.* [6] *Ibid.*

[7] The India, referred to by Damis in his account of Apollonius, on which the life of Apollonius as given by Philostratus depends, began from a region on the west of modern India. The mountainous region on the west of India was known as the Caucasus. This western region had Taxala as its capital and it was ruled over by an Iranian King, Phraotes, who was a Parthian.

[8] *Ibid*, Bk. iii, 6.

[9] *Ibid*, vol. ii, 28.

[10] I remember attending some such dinners at Sweden when I went to Stockholm in 1889. There also the guests serve themselves.

[11] *Ibid*, Bk. ii, 28, pp. 53-54. If the Parthians were Zoroastrian, this custom of drinking from the same cup looks strange as it is non-Zoroastrian.

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS (ORNITHOLOGICAL SECTION).

BY

HUGH WHISTLER, F.Z.S., M.B.O.U., ASSISTED BY N. B. KINNEAR, M.B.O.U.

(With two maps and one text-figure.)

In the *Journal* for July 1930 (vol. xxxiv, pp. 386–403), we furnished an introductory account of the genesis of the Vernay Survey of the Eastern Ghats and the work which it was expected to accomplish. The introduction was then followed by a preliminary report on the first collection which was sent in by Mr. LaPersonne from the Salem district. Since that report was written, the work of the Survey in the field has been completed, and the whole collection has been received at the British Museum.

The speed with which the specimens from the various collecting camps reached England and the paucity of field-notes from some of the camps, have led us to abandon the idea of reporting separately on the birds from each locality. It was found that this would lead to a good deal of reduplication of work. Single birds would take as much time to identify as complete series. Whilst in those cases where revision of a species or group was required, it would be sheer waste of time to write out in detail the results of an examination, whose value and results might be affected by material received in a subsequent batch.

No further local report has therefore been written. In the meantime, however, much work has been put in on the collections. We now propose to start the publication, in batches, of the result of our examinations of the collection as a whole.

It will, however, be desirable to explain, first of all, the manner in which we propose to deal with our material.

After a good deal of consideration, we have decided to deal with the survey material from two aspects, that of the Madras Presidency as a politically defined area, and from the general aspect of Indian Ornithology.

There can be no doubt that, ornithologically, the Madras Presidency is the least known part of India. It is not easy to understand why this should be so, but the fact remains. We think therefore it will be useful to write our report in the form of an account of the birds of the Madras Presidency, mentioning all species which have been recorded from the Presidency whether they have been met with by the Survey, or not. Under each species we shall detail briefly all that is recorded about it from within the Presidency limits. Our idea is that this account should bring to the notice of observers within the Presidency the points on which they can supplement published knowledge. The distribution of even the most common birds is imperfectly known, and if our account serves to underline this fact there will certainly be a response from local observers who alone can fill in the deficiencies.

Here a word of explanation is due. Since we started the preparation of this aspect of the report, Messrs. Inglis and H. R. Baker have published a book on the *Birds of Southern India*, by which is meant virtually the Madras Presidency. We have had to consider, therefore, whether this book nullifies this aspect of our report. We do not however think so. The authors expressly state that their book is a compilation, and it consists mainly of extracts from the new edition of the *Fauna*. The distributions are written in general terms and express not so much what are known to occur as what may be expected to occur. The result is not very accurate as the differences between the widely different areas included in the Presidency are marked and not always easy to foresee. We have therefore continued our original design, and because, (as explained below), we have gone back to original records. We have not quoted from the book except in respect of those records which are clearly original and published for the first time. This will explain why our account of the distribution of species in the Madras Presidency does not always agree with those in this book.

With regard to those species actually obtained by the Survey, we have gone into far greater detail. We have sought to make the new specimens the vehicle for a revision of the species represented. To this end we have done a great deal of work which will never appear on paper.

The first thing has been to collect and collate all published records that we could find bearing on the species within British India proper, keeping as a rule to the boundaries of British India, but taking cognizance of any records from Baluchistan, Kashmir, Assam, Burma and Ceylon which might appear to be useful and pertinent. These records have been plotted out on skeleton maps of India, similar to those used in the *Mammal Survey*. These published records have further been supplemented by any records we have collected from private correspondence and from the examination of specimens.

When the known range of the species within British India has thus been accurately discovered we have set ourselves to revise the question of geographical races. To this end we have examined and measured a vast amount of material. The main body of our material has of course been furnished by the huge collections of the British Museum. These have, however, been turned over by numbers of workers in the past 50 years. Our hope of finding new results of value are based on the fact that we have supplemented the material in the British Museum not merely with the specimens procured by the Survey, but by the large amount of fresh material contained in Dr. C. B. Ticehurst's collection from Sind and the large collections made in 16 years' service in N.-W. India by one of the authors of this report. In addition we have examined many other specimens contained in the Society's own collection as well as valuable material kindly provided by Mr. H. W. Waite, Colonel R. Sparrow, Colonel R. Meinertzhagen, Mr. A. E. Jones, Rev. F. S. Briggs, Mr. C. M. Inglis, Mr. D'Abreu of the Central Museum, Nagpur, the Director of the Zoological Survey, Calcutta, and Dr. Gravely of the Madras Museum. It will be a long time before so much material is again available, assembled for examination. We are obliged also to Dr. C. B. Ticehurst for reading through our manuscript and assisting us on many points.

In estimating the question of geographical races in India, we have somewhat departed from the customary method of procedure. This is to take the specimens from an established type locality as a basis, comparing all others with them as a starting point. This would be an excellent method if a type locality were originally fixed on scientific principles, so that one might deduce from it some fact such as the origin of the parent form. But it has seemed to us that the basis of the type locality, as at present established under the rules of priority in nomenclature, is necessarily haphazard and unscientific. To take the first species on our list for instance—the Jungle Crow—we find that Poona has been fixed as the type locality for the form *culminatus* on grounds of nothing more or less than historical accident. If the geographical races of the bird in India were negligible and science was merely concerned with the Jungle Crow as a species, a central type locality like this might be an advantage. But examining the races of the bird and finding marked differences in the bird at the three points of the Indian triangle, differences almost sufficient to separate three species if there were not connecting intermediate areas, we can only regard as unfortunate a type locality near the area, where all three races intergrade.

In our examination of every species, therefore, we have *at first* entirely disregarded published opinions and the established type localities of the Indian area. We have worked out the apparent Indian races with their distribution *de novo* and then to the result have applied the existing names and type localities. By this means we are able to recognize races which would not be *so* apparent by the method of comparing extremes, not with each other, but with an intermediate.

We are afraid that field-workers in India may not relish the fact that in many cases we have had to differ from the sub-species as recognized in the *New Fauna*. We are in sympathy with their feelings. Twenty years ago, working ornithologists in India were almost alone in the world in the happy possession of a uniform nomenclature, that of Blanford and Oates in the first edition of the *Fauna*. They worked to a uniform and neatly numbered catalogue. But it was at the cost of a static separation from the progress in ornithology in the rest of the world. The perfection of their happy separation has made their re-entry into world-currents the more difficult. European ornithologists have had a complete generation of gradual changes in which to accomplish the change to recognition of subspecies and the strict application of the laws of priority. Indian ornithologists have paid the penalty for compressing these changes into a dozen years, the usual penalties for haste. The *Handlist* upset the firmly established nomenclature of Blanford and Oates. Then the new *Fauna* upset the *Handlist*, and was again itself upset by its own volumes of synonymy and corrigenda. Now we fear that we shall propose a number of changes that will not agree even with the revised list in vols. vii and viii of the *New Fauna*.[1]

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[1] For the sake of brevity we propose to refer to the *Fauna of British India, Birds* by Blanford and Oates, 4 vols. 1889-1895 as the *Old Fauna* and to the *Fauna of British India, Birds*, second edition, by E. C. Stuart Baker, 8 vols. 1922-1930 as the *New Fauna*.

These changes will be found to fall into two categories. In some instances we are unable to agree with the names in the check-list of vols. vii and viii for reasons concerned with the ordinary application of the rules of nomenclature. In the majority of instances, however, the changes will be found due to the fact that we are unable to agree with the subspecies as defined in the *New Fauna*. This is partly due to the fact that we have examined more material than Mr. Stuart Baker, some of which was not available when he wrote. We have thereby been compelled sometimes to recognize races on differences which, to some, may seem small. But we consider that the study of races must be consistent. If the possession of a large beak is sufficient to separate *Parus major newtoni* of the British Isles from the continental form, the fact that *Microscelis psaroides* in Ceylon has a larger beak than in Peninsula India is also sufficient for the creation of a subspecies. The fact itself was recognized by Hume 50 years ago. It is useless recognizing the north-western and south-western races of *Pomatorhinus horsfieldii* and denying recognition to the other equally marked races. A small difference is just as important as a large difference provided that it is constant and is recognizable under the usual 75 per cent. rule.

One thing however Indian ornithologists must clearly recognize. Under the binomial system of the *Old Fauna*, clear-cut distributions were easy and possible. A species occurs or does not occur in an area and the only doubt on the point is the credibility of the evidence. Under the trinomial system it is seldom possible to define the ranges of the different subspecies in a continental area like India, because of the intergrading between the subspecies, which are generally easily distinguished at their further limits and grade inwards to a common centre. The worker at Cape Comorin and at Peshawar will have little difficulty in identifying his subspecies. The man in the Northern Central Provinces will, on the other hand, be able to be positive about very few races amongst the wide-spread species. This difficulty cannot be got over and it becomes more apparent with every increase in the number of specimens available. It is not peculiar to India, but to all continental areas and species with wide continuous distribution.

We do not think that there is much to be gained from the use of the $\lessgtr$ signs to express this intergrading. These may be useful in a report on a single collection from an isolated and little-known area. But once full material is available from a large and continuous area, one is forced to make a choice of either dropping these signs altogether or using them in such a variety of combinations that their value entirely disappears. Remembering therefore that nomenclature is but a system of labels and convenience, and not in itself an end, we have entirely dropped these symbols and have given our distributions as far as possible in general terms, placing the birds of intermediate areas under those forms with which their inclusion appears most satisfactory.

Finally, we should like to emphasize that there is still much more to be learnt about Indian birds, especially as regards distribution, migration and local movements. There is a huge area in the centre of the Peninsula between the Central Provinces and the southern boundary of Mysore which is virtually unknown and over which we have found no indication of the distribution of the most common species. So we urge all members of the Society to write to the *Journal* on any point, large or small, on which they can correct or supplement our conclusions.

In our introductory report we emphasized the debt of gratitude which ornithologists in general, and those of India in particular, owed to Mr. A. S. Vernay for making it possible for the Society to carry out the Eastern Ghats Survey. Now that all the specimens have come to hand, we would like to add that the results have fully justified the expense and trouble involved. Many new forms will need to be described from the collection. In addition, much new light has been thrown on the distribution and races of many other species already well known in other parts of India.

In all, about 1,550 birds were collected by Mr. V. S. La Personne who is to be warmly congratulated on the keenness and energy with which he pushed through the Survey. In the course of a year's collecting in places that were often wild and very unhealthy, he maintained the greatest interest in his work until the moment when malaria proved too much for the Survey and compelled a curtailing of its programme. We are happy to be able to state that the members of the Survey are now fully recovered from the effects of their malaria. A special word of praise is due to the way in which Mr. La Personne prepared his skins. From first to last, the birds have been collected with a uniform level of technical skill that can seldom have been surpassed.

For purposes of record we have, under each species, given a list of the actual specimens collected in the course of the Survey with a summary of their measurements. Unless otherwise stated, the measurement of the bill is taken from the actual base at the skull in a direct line to the tip. The tail measurement is taken with callipers. One point is inserted between the base of the two central feathers; the other is extended to the tip of the longest feather, whether central or external. The wing and tarsus are measured in the customary way.

Under the heading of each form we have inserted the original reference, date and type locality on which that name is based. In those cases where a summary of the Indian forms is given under the account of the race obtained by the Survey, the reference is inserted in the summary and not under the heading. In these summaries we have not arranged the races in chronological order. The sequence has been determined only by the convenience of each particular case and so varies. A bibliography of papers and records referring to the Madras Presidency with a note on previous collectors who have worked there will be given as an appendix.

A map has been specially prepared under the auspices of the Royal Geographical Society to show the collecting camps and the principal features of the Madras Presidency.[1] As the camps eventually differed somewhat from the original programme, detailed on pp. 387–8 of our introductory report, we now give the following summary of them.

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[1] This map was specially drawn by Mr. H. F. Milne, and we are much obliged to him for the excellence of his work.

ITINERARY

Salem District—
8th April 1929 to 7th May 1929.
Kurumbapatti Forest Reserve 1,000–1,500 ft.
10th May 1929 to 26th May 1929.
Shevaroy Hills. Camps at varying altitudes 3,500–5,000 ft.
28th May 1929 to 9th June 1929. Foot of Chitteri Plateau 1,500–2,000 ft.
10th June 1929 to 17th June 1929. East Chitteri Hills 3,000 ft.
19th June 1929 to 24th June 1929. Plains north of Chitteri Hills 500–1,000 ft.

Trichinopoly District—
1st July 1929 to 12th July 1929.
30 miles from Trichinopoly town.

South Arcot District—
14th July 1929 to 25th July 1929.
Gingee forest and open country around Tindivanam.

South Cuddapah District—
29th July 1929 to 28th August 1929.
Balapalli. Palkonda Hills 1,000 ft.
30th August 1929 to 21st September 1929.
Kodur. Below Palkonda Hills 500–1,000 feet.
23rd September 1929 to 27th October 1929.
Guvalacheruv 1929. Seshachalam Hills 2,000 ft.

South Kurnool District—
29th October 1929 to 1st December 1929.
Diguvametta, Nallamalai Hills 2,000 ft.
2nd December 1929 to 2nd January 1930.
Cumbum Valley, Cumbum, 1,000–1,500 ft.

Godavari Delta—
4th January 1930 to 31st January 1930.
Godavari Delta.

Vizagapatam District—
4th February 1930 to 28th February 1930.
Eastern Ghats. Anantagiri 3,000 ft.
1st March 1930 to 19th April 1930.
Eastern Ghats. Sankrametta 3,500 ft.
20th April 1930 to 15th May 1930.
Eastern Ghats. Jeypore Agency.
18th May 1930 return Bombay.

Corvus macrorhynchos culminatus Sykes.

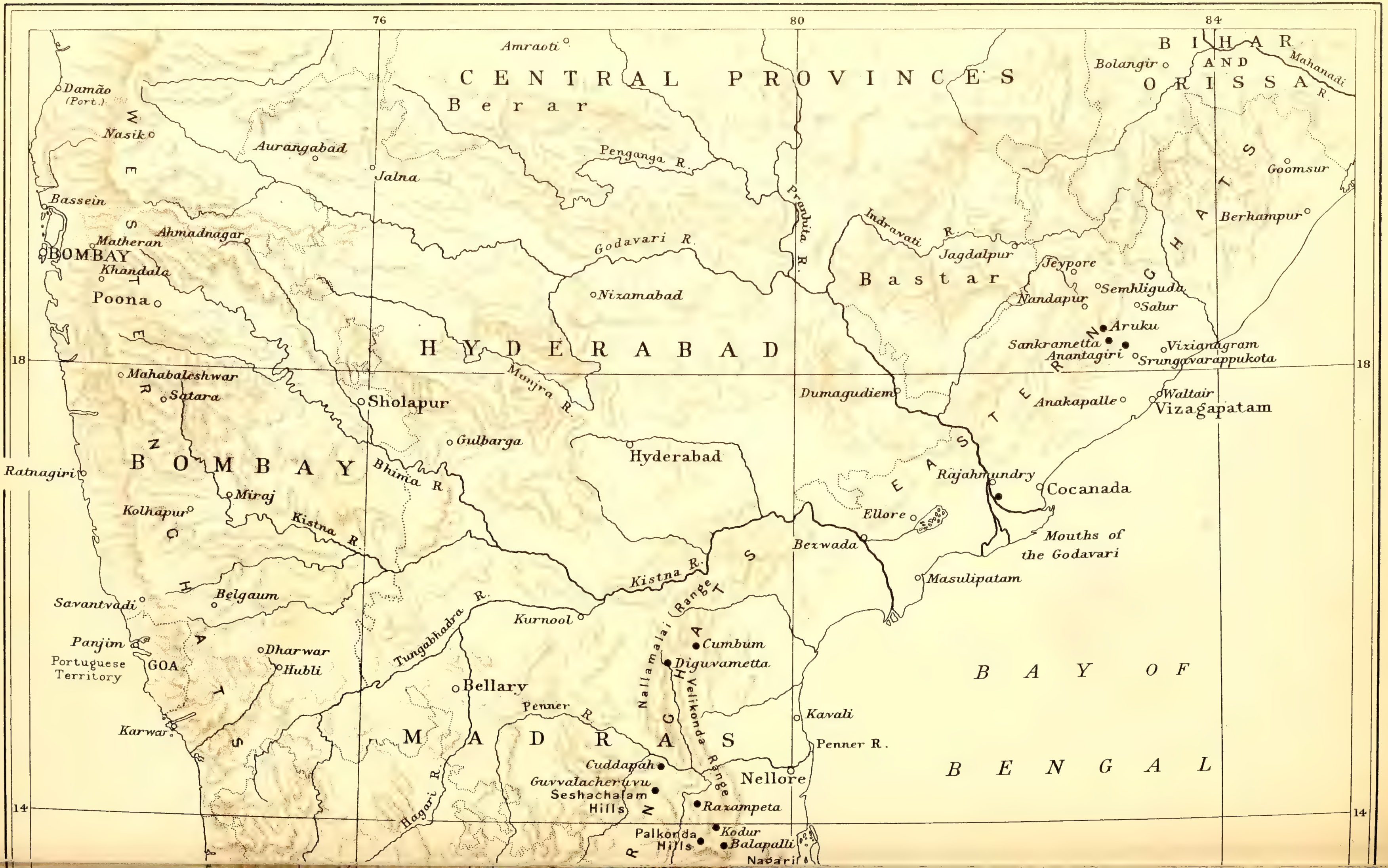
Specimens collected :—91 ♀ 19-4-29, 104 ♀ 21-4-29 Kurumbapatti ; 294 ♂ 30-5-29, 391 ♀ 12-6-29 Chitteri Hills, 2,000 ft. ; 1412 ♀ 19-2-30 Anantagiri 3,000 ft.

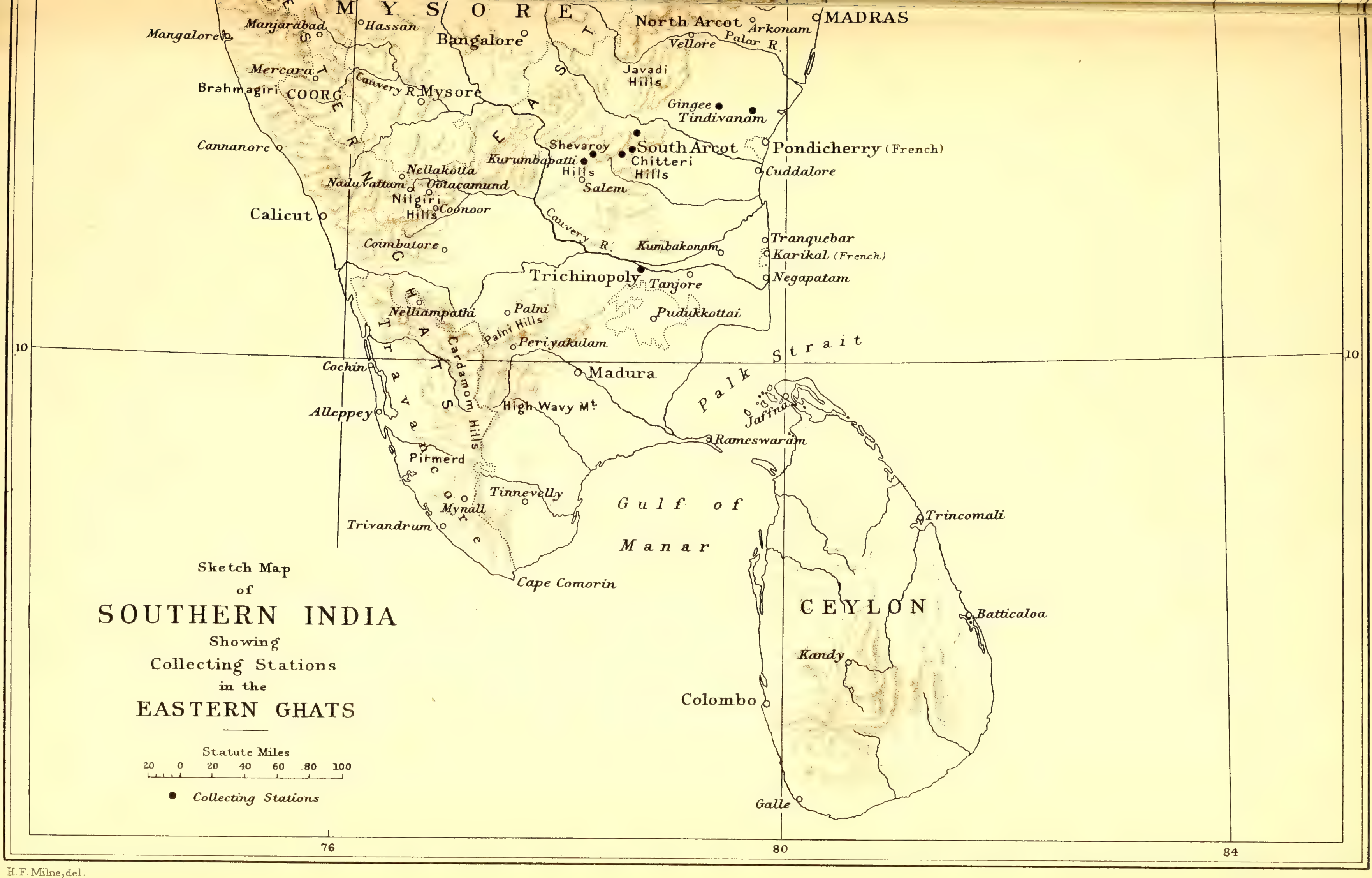
Measurements—

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	62	278	176	54·5 mm.
4 ♀	56 5-58	279–297	167–174	55 mm.

As remarked in our first report (xxxiv, 390) there has been much difference of opinion as to the correct systematic treatment of the Jungle-Crow. Since we wrote, the question of whether this bird should be accepted as conspecific with the Australian *coronoides* has been settled in the negative (Hartert, *Nov. Zool.* xxxv, p. 53, 1929), and in his final volume Mr. Stuart Baker has accepted the change, regarding the Asiatic forms as forming one group. He has however fallen into the error of calling the species *levaillanti*. As pointed out by Delacour (*Ibis* 1930, p. 599), *macrorhynchos* is the older and correct name.

We are by no means certain, however, that further investigation will not show that the Jungle-Crows are merely oriental races of *Corvus corone*. It must be remembered that the two forms are exceedingly difficult to differentiate both in the museum and the field, and much of the supposed overlapping on the borders of N.-W. India is demonstrably due to wrong identification.

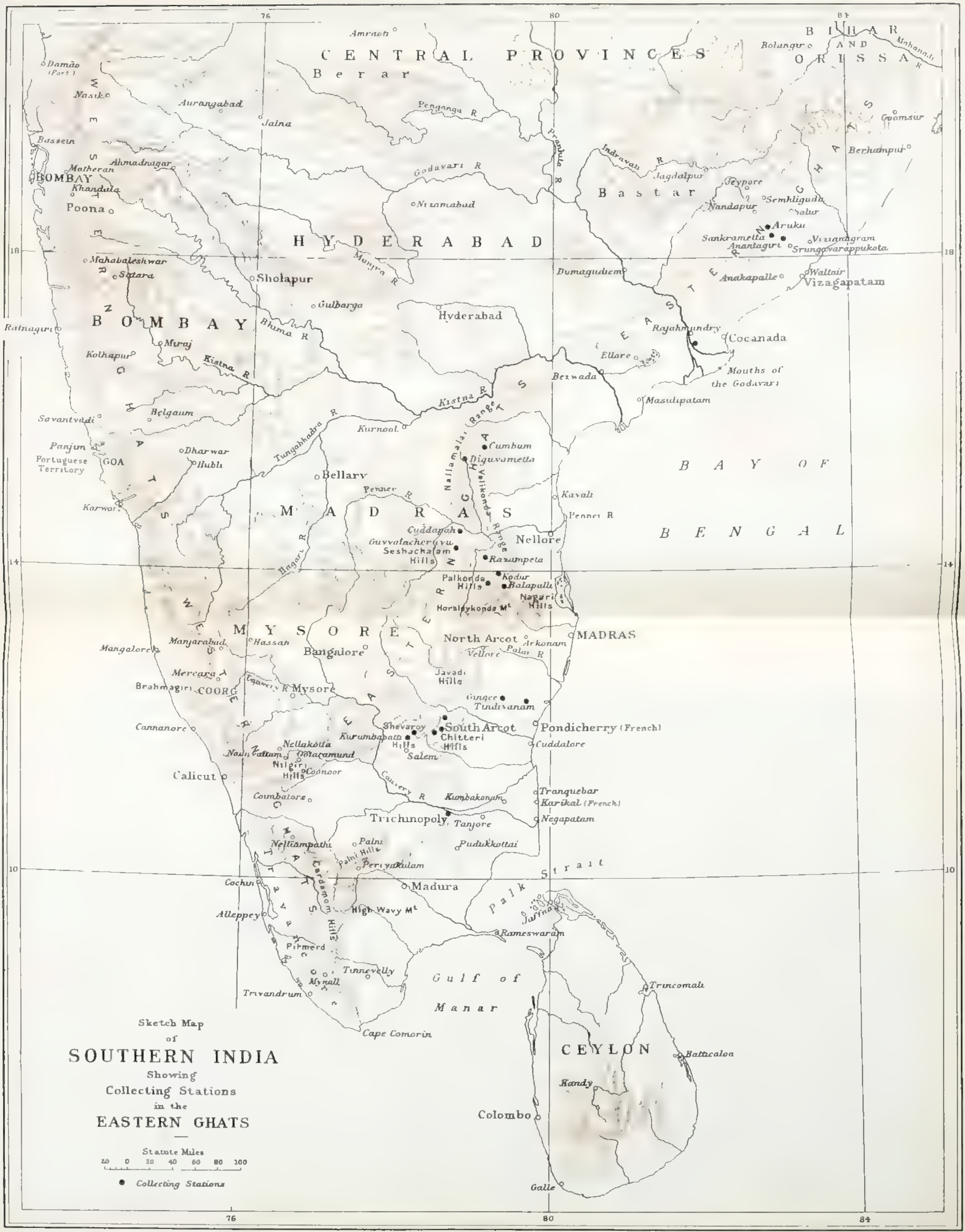

76
80
84
18
14
CENTRAL PROVINCES
Berar
BIHAR AND ORISSA
Mahanadi R.
Bolangir
Amraoti
Damão (Port.)
Nasik
Aurangabad
Jalna
Penganga R.
Pranhita R.
Indravati R.
Jagdalpur
Bastar
Jeypore
Semhliguda
Salur
Nandapur
Aruku
Sankrametta
Anantagiri
Vizianagram
Srungavarappukota
Goomsur
Berhampur
Bassein
BOMBAY
Matheran
Ahmadnagar
Khandala
Poona
Godavari R.
Nizamabad
HYDERABAD
Manjra R.
Mahabaleshwar
Satara
Sholapur
Gulbarga
Dumagudiem
Anakapalle
Waltair
Vizagapatam
Ratnagiri
BOMBAY
Bhima R.
Hyderabad
Rajahmundry
Cocanada
Miraj
Kolhapur
Kistna R.
Ellore
Mouths of the Godavari
Bezwada
Masulipatam
Savantvadi
Belgaum
Kurnool
Tungabhadra R.
Nallamalai Range
Cumbum
Diguvametta
Velikonda Range
Panjim
Portuguese Territory
GOA
Dharwar
Hubli
Bellary
Penner R.
Kavali
Penner R.
Karwar
MADRAS
Cuddapah
Guvvalacheruvu
Seshachalam Hills
Nellore
Razampeta
Hagari R.
Palkonda Hills
Kodur
Balapalli
Nagari
WESTERN GHATS
EASTERN GHATS
BAY OF BENGAL


MYSORE
Mangalore
Manjarabad
Hassan
Bangalore
Mercara
Brahmagiri
COORG
Cauvery R.
Mysore
Cannanore
Calicut
Nellakotta
Naduvattam
Ootacamund
Nilgiri Hills
Coonoor
Coimbatore
WESTERN GHATS
EASTERN GHATS
North Arcot
Arkonam
MADRAS
Vellore
Palar R.
Javadi Hills
Gingee
Tindivanam
South Arcot
Pondicherry (French)
Shevaroy
Kurumbapatti
Hills
Chitteri Hills
Salem
Cuddalore
Cauvery R.
Kumbakonam
Tranquebar
Karikal (French)
Negapatam
Trichinopoly
Tanjore
Pudukkottai
Nelliampathi
Palni
Palni Hills
Periyakulam
TRAVANCORE
Cardamom Hills
Cochin
Alleppey
Madura
High Wavy Mt
Pirmerd
Tinnevelly
Mynall
Trivandrum
Cape Comorin
Palk Strait
Jaffna
Rameswaram
Gulf of Manar
Trincomali
CEYLON
Batticaloa
Kandy
Colombo
Galle
10
10
76
80
84
Statute Miles
20 0 20 40 60 80 100
● Collecting Stations

Sketch Map
of
SOUTHERN INDIA
Showing
Collecting Stations
in the
EASTERN GHATS

H. F. Milne, del.

John Bale Sons & Danielsson Ltd London.


CENTRAL PROVINCES
BIHAR AND ORISSA
Berar
HYDERABAD
BOMBAY
MADRAS
MYSORE
Bastar
COORG
BAY OF BENGAL
Gulf of Manar
Palk Strait
CEYLON
WESTERN GHATS
EASTERN GHATS
Nallamalai Range
Velikonda Range
Palni Hills
Cardamom Hills
Travancore
Amraoti
Damão (Port.)
Nasik
Aurangabad
Jalna
Bassein
Matheran
BOMBAY
Khandala
Ahmadnagar
Poona
Mahabaleshwar
Satara
Sholapur
Gulbarga
Ratnagiri
Miraj
Kolhapur
Belgaum
Savantvadi
Panjim
GOA
Portuguese Territory
Dharwar
Hubli
Karwar
Bellary
Kurnool
Hyderabad
Nizamabad
Penganga R
Godavari R
Manjra R
Bhima R
Kistna R
Tungabhadra R
Penner R
Hagari R
Pranhita R
Indravati R
Jagdalpur
Jeypore
Nandapur
Semiliguda
Salur
Aruku
Sankrametta
Anantagiri
Vizianagram
Srungavarappukota
Goomsur
Berhampur
Bolangir
Mahanadi R
Dumagudiem
Anakapalle
Waltair
Vizagapatam
Rajahmundry
Cocanada
Ellore
Mouths of the Godavari
Bezwada
Masulipatam
Cumbum
Diguvametta
Kavali
Penner R
Cuddapah
Guvvalacheruvu
Seshachalam Hills
Nellore
Razampeta
Palkonda Hills
Kodur
Balapalle
Nagari Hills
Horsleykonda Mt
MADRAS
North Arcot
Arkonam
Vellore
Palar R
Javadi Hills
Gingee
Tindivanam
Pondicherry (French)
Cuddalore
South Arcot
Shevaroy
Kurumbapatti Hills
Chitteri Hills
Salem
Mangalore
Manjarabad
Hassan
Bangalore
Mercara
Brahmagiri
Cauvery R
Mysore
Cannanore
Nellakotta
Naduvattam
Ootacamund
Nilgiri Hills
Coonoor
Calicut
Coimbatore
Cauvery R
Kumbakonam
Tranquebar
Karikal (French)
Trichinopoly
Tanjore
Negapatam
Nelliampathi
Palni
Periyakulam
Pudukkottai
Madura
Cochin
Alleppey
High Wavy Mt
Jaffna
Rameswaram
Pirmerd
Tinnevelly
Mynall
Trivandrum
Cape Comorin
Trincomali
Batticaloa
Kandy
Colombo
Galle
76
80
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18
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Statute Miles
20 0 20 40 60 80 100
● Collecting Stations

Sketch Map
of
SOUTHERN INDIA
Showing
Collecting Stations
in the
EASTERN GHATS

H. F. Milne, del.

As regards the races of Jungle-Crow within Indian limits there has been also some difference of opinion. To take two recent instances: Mr. Stuart Baker divides the birds of the Peninsula into two races *levaillanti* and *culminatus*. The former, he considers, occupies ' the whole of India south of the Himalayas, as far South as the Deccan and on the East to about the latitude of the Madras Presidency. To the North-east it is found up to the Bay of Bengal, but East of the Brahmaputra its place is taken by the Burmese form '. *Culminatus*, on the other hand, he considers as occupying ' India in the Madras Presidency southwards, the Deccan and South through Malabar and Travancore to the South of Ceylon '.

Meinertzhagen however (*Nov. Zool.* xxxiii, 1926, p. 85) differed considerably from this treatment. He placed the boundary between the two forms far lower in the Peninsula, namely ' south at least to Madras and the Nilgiri Hills ' thus making *culminatus* a synonym of *levaillanti* and using *anthracinus* of Madarasz for the Southern race. Both these writers have made the mistake of keeping the measurements of the sexes together. They have also apparently failed to appreciate the fact that at the post-juvenile moult, the wing and tail-quills are not shed but retained so that all measurements of wing and tail of birds in their first year refer to the juvenile plumage and are so quite misleading. Had they appreciated this point, Meinertzhagen would have avoided (*loc. cit.* p. 83) dismissing the type of *culminatus* ' as a very small specimen ', ' an aberrant specimen and not typical '—' similar dwarf examples occur at Simla, etc., but are exceptional '. It is in fact an immature bird completing the post-juvenile moult, and perfectly normal for its age. Whilst Stuart Baker would not have required (vol. i, p. 29) to have suggested that the late Summer birds which decreased the average measurements ' may well be visitors from the plains wandering into the hills after breeding '.

It was disappointing to find that the Survey had missed the opportunity of collecting a large carefully-sexed series of Jungle-Crows. For since all writers on the subject had arrived at different results from the examination of the same material in the Hume collection, the obvious need was to get fresh material. At our suggestion, however, with the co-operation of the Indian Museum, the Nagpur Central Museum, and the Madras and Trevandrum Museums, the Society was able to collect some fresh specimens. Combined with those in the Whistler collection this new material amounted to over 70 birds, of which the majority were from the N.-W. Himalayas, Calcutta and Bombay, virtually to potypes that is of *intermedius*, *levaillanti* and *culminatus*. With this basis we have re-examined the crows in the Hume collection.

The result shows that there can be no hard and fast line of demarcation between the races. Individual variation is great so that individuals as well as first-year birds interrupt slightly any orderly sequence of measurements. But allowing for this there is a regular and gradual intergradation between the crows of the whole of India from a small-billed race in Ceylon to a large bird with a small bill in the Western Himalayas and a medium-sized bird with a deeply-bowed Raven beak in Bengal. The sequence continues eastwards until we reach the huge bird with the huge beak of Java. The facts are clear. The problem largely resolves itself into one of convenience as to the best way to express these facts.

Birds from the N.-W. Himalayas present no difficulty. Their habitat is largely isolated. That the same race extends to the Eastern Himalayas is a matter of supposition. No series exists to prove the point.

It is clear moreover that birds from Ceylon and Bombay and Nagpur and Vizagapatam cannot be separated, whereas they differ most markedly from the Calcutta series[1] with the strongly curved Raven beak (*vide* text figure, p. 512). This latter we cannot separate in any way from the Assam, Burma and Andaman birds.[2] The measurements speak for themselves on this point.

		Bill.	Wing.	Tail.	Tarsus.
4 ♂	Calcutta	61-66	310–328	186·5-196·5	58–59 mm.
5 ♂	Andamans	60·5–67·5	265–322	167–199·5	53·5–59 mm.
8 ♀	Calcutta	55·5-65	283–305	165–182	52·5–56·5 mm.
5 ♀	Andamans	60·5-65·5	287-307	164-185	53·5-56 mm.

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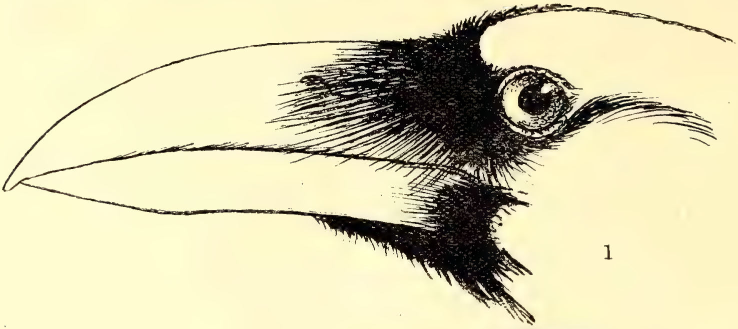
[1] *Corvus levaillanti* Lesson, Traité d'Orn. (1831), p. 328—Bengal.

[2] *Corvus andamanensis* Beavan, Ibis 1866 (October), p. 420—Andamans.



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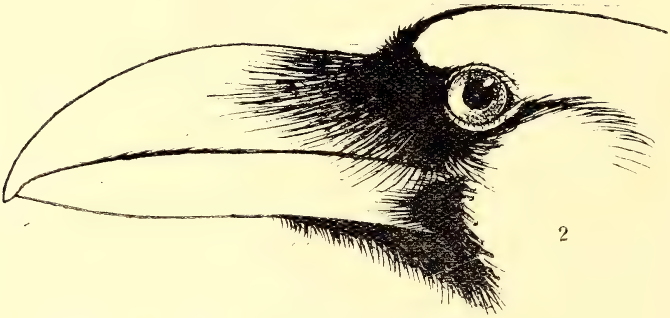

2

FIG. 1. *Corvus macrorynchos culminatus*, Mahim, Bombay.
FIG. 2. *Corvus macrorynchos macrorynchos*, Chakada, Nadia, Bengal.

The birds of the Gangetic plain of the United Provinces and Bihar are in truth intermediate between the two series, but it will be most convenient to unite them with *culminatus*, and in agreement with the established practice of regarding them as separable from the larger-billed form.

Delacour (*Ibis* 1930, 598) unites these large-billed Andaman birds with *macrorhynchos*. *Macrorhynchos* has the bill up to 73·5, and the wing up to 361 mm., a figure never reached by Andaman birds. But if we include in one form in the gradation in size from Calcutta to Java we are not accepting a wider grading of size than we get in the area assigned to *culminatus* from Ceylon to the Ganges.

We accordingly recognize the following Indian races[1] :—

Corvus macrorhynchos intermedius Adams.

Corvus intermedius Adams, P. Z. S., 1859, p. 171—Kashmir, Dagshai and Simla, restricted[2] to Kashmir.

A large bird with a weak bill. Plumage a comparatively dull greyish black with little gloss on the hind neck and lower parts. Base of the nape feathers usually whiter than in other forms.

	Bill.	Wing.	Tail.	Tarsus.
33 ♂	54–65	311–365	193·5–241·5	52·5–60 mm.
17 ♀	54–65	292–343	173·5–224	51–56 mm.

'Himalayas from Afghanistan to Bhutan' (Stuart Baker). It is said to breed on the boundary hills of the N.-W. Frontier but no specimens exist from this area. The extension of this race to the Eastern Himalayas is similarly unsupported by a proper series of skins.

Corvus macrorhynchos culminatus Sykes.

Corvus culminatus Sykes, P. Z. S., 1832 (July) p. 96—Dukhun = Poona.

A small bird with a strong beak. Plumage black and glossy. Base of nape feathers dusky.

	Bill.	Wing.	Tail.	Tarsus.
18 ♂	54·5–66·5	274–317	156–189	48·5–56·5 mm.
22 ♀	54·5–63	260–301	147–182·5	48·5–55 mm.

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[1] Range of measurements includes adults and first-year birds.

[2] Stresemann, Verhandlungen der Orn. Geselleschaft in Bayern, xii (1916), p. 282.

The Indian Peninsula and Ceylon.

The Jungle-Crow does not occur throughout Northern India as stated in the *Fauna*. It is absent from the whole plains area north-west of a line from Delhi to the eastern border of Sindh, in which area it is largely replaced by the Raven.

Corvus macrorhynchos macrorhynchos Wagler.

Corvus macrorhynchos Wagler, Syst. Av., *corvus* sp. 3 p. 313, 1827—Java.

A large bird with a heavy deeply-bowed beak. Base of nape feathers dusky: deeper and more glossy black than other races. Measurements (Calcutta only):—

	Bill.	Wing.	Tail.	Tarsus.
4 ♂	61-66	310-328	186·5-196·5	58-59 mm.
8 ♀	55·5-65	283-305	165-182	52·5-56·5 mm.

From the vicinity of Calcutta through Assam and Burma to Java. The Andamans.

Corvus tenuirostris Moore, Catalogue, Vol. II, p. 558, 1858, is wrongly attributed to the synonymy of this species in the *New Fauna*, vol. vii, p. 2. The type is in the British Museum and is a specimen of *Corvus enca compilator* Richmond, from Sumatra, Borneo, Malay, etc.

So far as is at present known the Jungle-Crow is very generally distributed throughout the whole of the Madras Presidency except in certain of the hill ranges of the South-West. In this Presidency the bird somewhat differs in habits as compared with other parts of India. It is a very common and familiar species vying with the House-Crow as a parasite of towns and villages, occurring with that bird and often in greater numbers.

In Vizagapatam[1] La Personne found it common from the coast into the interior both in the plains and on the hills and this seems to be its status all down the eastern side of the Presidency. In the Nilgherries and the Wynaad it is exceedingly common everywhere, being the common crow of Ootacamund and the other hill stations. In Coorg it is common wherever there are human habitations, occurring also, though in smaller numbers, throughout the jungle. In South Kanara and Malabar we have no information about it.

South of the Palghat Gap it is far less generally distributed. In the Nelliampathy Hills it does not occur at all according to Kinloch, and Fairbank noticed and Bates has since confirmed that it is entirely absent from the summit of the Palnis, where the former placed its limit about Vilpati 5,500 ft. Although Ferguson found it common throughout Travancore, he also noted its absence from the Southern hills.

Throughout the Presidency the breeding season appears to be fairly regular, from about February until June. In the Nilgiris most eggs will be found in April and May and this is the case everywhere. Bates however remarks that although the Jungle-Crows commence to breed about February at Madras in the drier climate of Trichinopoly, they do not start until May.

Corvus splendens splendens Vieillot.

Corvus splendens Vieill., *Nouv. Dict. d'Hist. Nat.*, viii. 1817, p. 44—Bengal.

Specimens collected:—185 ♀ 186 O ? 4-5-29 Kurumbapatti; 537-8 ♂ ♂ 9-7-29. Vyampatti, Trichinopoly; 1040 ♀ 25-11-29 Nallamalai Range 2,500 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
2♂	50-50·5	266-268·5	162-168·5	47-50 mm.
2♀	45·5-50	252-253	154·5-155	45-48 mm.

Everyone neglects this common and familiar species with the result that there is very little material for examination from lower Peninsula, India and Ceylon, though 12 fresh specimens from Calcutta and 10 from Nagpur were kindly collected for the Survey by the Zoological Survey of India and the Nagpur Museum. The five specimens collected by La Personne agree with the Calcutta series though their slightly weaker beaks remind one of the complete intergradation throughout our area between *protegatus*, the dark Cinghalese bird and *zugmayeri*, the very pale bird of the desert and semi-desert areas of the North-west.

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[1] McMaster (*J.A.S.B.* 1871, 212) curiously enough says that he could not find it at Waltair.

On the whole the House-Crow is less generally distributed throughout the Madras Presidency than the Jungle-Crow, though in the towns its numbers are certainly larger. In Vizagapatam, La Personne considered that it did not penetrate into the interior to any considerable extent and in the Godavery delta it was mainly concentrated in the towns. Throughout the rest of the Presidency east of the Nilgiris and Travancore it is evidently generally distributed, common in the neighbourhood of man and absent from forest tracts. In Madras City it is a positive pest and according to Dewar who dilates at length on its habits there, its numbers must far exceed the human population. An albino at Madras is recorded in *S. F.* ix, 507.

In the Nilgiris the House-Crow is evidently a recent colonist. Davison specifically remarks that in his day it did not ascend the hills and was absent also from parts of the low country at their base, as for instance from Goodalore to Nellacotta. While McMaster also says that the Jungle-Crow was 'the only crow of the Nilgherries, replacing his grey cousin at Kullar, the posting stage at the foot of the Kunur Ghat to which place, and no further, *splendens* had penetrated in 1870'. Bates informs us (*J.B.N.H.S.* xxxi, 291) that in the Nilgiris the House-Crow is now common ; indeed almost as numerous as the Jungle-Crow. In the Wynaad also it was absent from the hills in Davison's day but we have no information whether it has since colonised that area. In Coorg it is still uncommon, a few odd pairs only to be seen about the villages.

South of the Palghat Ghat the House-Crow is entirely absent from the Nelliampathy and Palni Hills, and perhaps also from the various Travancore ranges though there does not seem to be any very definite information on this point. Outside the hills it is at any rate common throughout the State.

No one has troubled to record much about the breeding of this common bird except that Dewar gives June, July and August as the breeding season in Madras City. In Vizagapatam, La Personne saw birds building in the middle of April and in the Palkonda Hills in August. In Travancore, according to Bourdillon, the eggs are not laid before June, but Ferguson took eggs in February.

In the rain area of Malabar and South Kanara, the breeding season may well agree with that of North Kanara where Davidson found that the crows bred in October and November to avoid the heavy rain.

Dendrocitta vagabunda vagabunda (Latham).

Specimen obtained :—1605 ♂ 26-3-30 Sankrametta 3,000 ft.

Measurements :—Bill 34, wing 145, tail 204, tarsus 33.

In the northern portion of the Madras Presidency down to the valley of the Godavery the Indian Tree-Pie is distinctly scarce and La Personne notes that he only saw single birds at Anantagiri and Sankrametta. The latter (♂) was secured and proves to be quite different to all specimens collected south of the Godavery. It agrees well with a female in the British Museum obtained by Blanford in January 1871 in the Godavery valley near Dumagudiam, and both birds though slightly intermediate in character must evidently be included under the typical race.

Consideration of the magpies collected by the survey immediately introduced two difficult problems, the correct name of the species and the races to be recognized in India. Of late years the name of this bird has oscillated between *Dendrocitta rufa* and *D. vagabunda*, the former being used again in the new edition of the *Fauna*. The bird was first described as *Lanius rufus* [1] by Scopoli (1786) but that name is unfortunately preoccupied by *Lanius rufus* of Linnæus 1766. Latham in 1790 independently described it as *Corvus rufus*.[2] Mr. Stuart Baker is of opinion that this name may stand but we agree with Ticehurst (*Ibis* 1931, p. 585) that as *Lanius rufus* and *Corvus rufus* are admittedly the same bird the specific name is not rendered tenable by the change of genus. This being so we have no option but to use the next oldest name which is *vagabunda*. The Malabar form is then left without a name.

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[1] *Lanius rufus* Scopoli, *Del. Faun. et Flor., Insub.*, vol. ii (1786), p. 86.

[2] *Corvus rufus* Latham Index Orn. vol. i (1790), p. 161.

Both descriptions are based on '*La Pie rouse de la Chine*' in Sonnerat's 'Voyage aux Indes Orientales et la Chine', pl. 106, p. 186. As the bird does not occur east of Indo-China, Stuart Baker has fixed Malabar as the type locality.

In our first report we mentioned the divergence of opinion between Ticehurst and Stuart Baker as to the races of the Tree-Pie in India. This has been partly reconciled by Stuart Baker's final admission (*New Fauna* viii, p. 7) of Blyths' *pallida* for the large pale birds of N.-W. India. We also said that in our opinion neither treatment was entirely satisfactory and this view has been justified by the survey series.

Ticehurst had hinted at the possibility of southern birds being separable on their smaller size, but the real position was obscured rather than suggested by the material in the British Museum. The series from south of the Nilgiris consisted of the following specimens, all old and unsexed, 4 from Madras, 1 from Calicut, 1 from Malabar and 6 from Travancore. All are precisely alike, small and richly coloured, agreeing in tint with Bengal birds. They stand out markedly however from the birds from Mysore and the Nilgiris which are pale and at a casual examination recall the birds of the north-west. Individual variation was formerly considered to cover both pale and dark birds.

The survey series however cleared up the position. All birds obtained by La Personne south of the Godavery agree in being small and very pale and quite unlike the dark birds enumerated above. It was immediately suggested therefore that this species agreed with many others in having a dark saturated race in the rain-areas of the South-West and a pale race in the dry Carnatic. The only objection to this theory lay in the four birds marked 'Madras'. Two of these are from the Gould collection and two from H. H. Baker (misspelt *Baber* on the labels which are not original). It is known that H. H. Baker's birds were mostly collected in Malabar through nothing is known of the source of these Gould specimens. All four agree so exactly with the other specimens from Malabar and Travancore and are so different to the survey series that we feel justified in concluding that 'Madras' on the labels stands not for the town but for the Presidency and that these birds came from the western side. The loose use of the word 'Madras' for the whole Presidency was a commonplace of 50 years ago and is still hardly extinct.

We accordingly recognize the following races in India :—

Dendrocitta vagabunda vagabunda (Latham).

Coracias vagabunda Latham, *Index Ornith.*, vol. i (1790), p. 171—India restricted to Calcutta.[1]

Large richly coloured race. Back and scapulars dark brownish rufous ; rump belly and lower tail coverts fulvous buff.

	Bill.	Wing.	Tail.	Tarsus.
14 ♂	31–35	142–158·5	204–253	31–34 mm.
4 ♀	31–33	136·5–149	198–225	31–32 mm.

Outer Eastern Himalayas from Nepal to Assam, extending to those parts of India not occupied by other forms, and intergrading with them.

Dendrocitta vagabunda pallida Blyth.

Crypsirina pallida Blyth, *J.A.S.B.*, xv (1846), p. 30—Western Himalayas, restricted[1] to Simla.

The largest race, much paler than all others except *vernayi*. Back and scapulars isabelline with a tinge of dusky but devoid of rufous ; rump paler ; belly and lower tail coverts pure isabeline or buff cream colour.

	Bill.	Wing.	Tail.	Tarsus.
12 ♂	32·5–35	153–173	242–315	33·5-36·5 mm.
9 ♀	30–34	156-164	250–295	32–35·5 mm.

Outer Western Himalayas, N.-W.F.P., Punjab, Rajputana and Sindh.

Dendrocitta vagabunda parvula *nom. nov.* for *Corvus rufus* Latham, *Index Ornith.*, vol. i (1790) p. 161 (Malabar). Similar in colour to the typical race but much smaller.

Twelve specimens unsexed measure :—

Bill	Wing	Tail
30·5–31·5	133–151·5	188·5–238·5 mm.

West Coast from S. Kanara to Cape Comorin.

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[1] Ticehurst *Ibis*. 1922, p. 537.

Dendrocitta vagabunda vernayi Kinnear and Whistler.

Dendrocitta rufa vernayi Kinnear and Whistler, ***Bull B.O.C.*** cccxliv, vol. li, p. 17 (1930—Nallamalai range 2,000 ft. S. Kurnool).

Small race, paler even than *D. v. **pallida***; the chin throat and breast are almost sooty grey and the abdomen pale creamy fulvous.

	Bill.	Wing.	Tail.	Tarsus.
12 ♂	29–34·5	144·5–157·5	201–226	31–33·5 mm.
9 ♀	29·5–32·5	139–149·5	187·5–224	31–32·5 mm.

South East India, South of the Godavery, S. E. Hyderabad, Mysore and the Nilgiris.

The above measurements include both adults and first-year birds. The latter are easily distinguishable from adults by the pale tips to the tail feathers. They are generally smaller.

D. rufigaster Gould ***P.Z.S.***, 1838, p. 80, is wrongly given in the *New Fauna* (vii, p. **6**) in the Synonymy of this species from which the white nape at once distinguishes it. The description agrees better with ***D. occipitalis*** (Muller) from Sumatra.

Dendrocitta vagabunda parvula Kinnear and Whistler.

The range of this form in the Presidency lies outside the path of the Survey. There is nothing on record to show the boundary between it and *D. v. vernayi* but it presumably is confined to the area of heavy rainfall.

In Travancore according to Ferguson it is found in the low country between the hills and the coast and does not ascend the ranges at all. It is very rare on the Nelliampathis (Kinloch) but Fairbank obtained it at 5,000 ft. on the Palnis. There is no definite information about the bird in Malabar and South Kanara beyond the specimens from the former district in the British Museum.

In Travancore according to Ferguson it breeds in the S.-W. Monsoon, that is between the middle of May and the middle of September.

Dendrocitta rufa vernayi Kinnear and Whistler.

Specimens collected:—82 ♂ 18-4-29 Kurumbapatti; 239 ♀ 17-5-29, 255 ♀ 20-5-29 Shevaroys; 375 ♂ juv. 9-6-29, 382 ♂ 11-6-29 Chitteri range 3,000 ft.; 729 ♀ 22-8-29, 770 ♀ 28-8-29 Palkonda Hills 1,000 ft.; 847 ♂ 28-9-29 Seshachalam Hills 2,000 ft.; 957 ♂ 1-11-29, 1027 ♀ 22-11-29 Nallamalai range 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
5 ♂	29–33	145–157·5	197–210	31–32·5 mm.
5 ♀	30–32·5	139–149·5	187·5–224	31–32 mm.

South of the Godavery, in all localities visited by the Survey from the islands of the delta, the various ranges up to 4,500 ft. (Nallamalais, Palkonda. Seshachalam, Shevaroys, Chitteri) to the plains round Kurumbapatti and Trichinopoly, the Tree-Pie was very common in all types of country and jungle. All specimens obtained in this area belong to the small pale race which we have named *vernayi* and it presumably occurs throughout the whole of the presidency down to Cape Comorin. Westwards this race extends to the Nilgiris and parts of Hyderabad and Mysore. In the Nilgiris according to Davison it is common up to 5,000 ft. more numerous at low elevations and gradually decreasing up to that limit, but in many years he only once met it above that elevation, at 6,500 ft. about 7 miles from Ootacamund. The breeding season is not recorded.

Dendrocitta leucogastra Gould.

Dendrocitta leucogastra Gould, *P. Z. S.*, 1833 (July 5), p. 57—Eastern Asia, Malabar Coast.[1]

The Southern Tree-Pie was not met by the Survey and its range lies to the west of the areas worked. Its distribution is not very clearly given in the *New Fauna*. McMaster (*J. A. S. B.*, 1871, pt. 2, p. 214) states that he procured a specimen in May at Chikalda in the Gawilgurh Hills, but this record certainly must be regarded with suspicion until confirmed.

The most northerly authentic records are for N. Kanara where A. T. Crawford (*S. F.* x. 422) first obtained a specimen and James Davidson later found it very local and confined to the ghats, and ever rare where found. His account, substantiated by specimens now in the British Museum, is as follows :—' The place I have seen it oftenest is at Nilkund on the crest of the ghats between Siddapur and Kumta. I have also seen it at Davimane on the crest of the ghats between Sirsi and Kumta and in the broken country West of Siddapur.' T. R. Bell saw a pair on the Bhara Ghat a little further north.

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[1] The specimen in the British Museum labelled in the handwriting of Gould's Secretary 'Dendrocitta leucogastar Gould Irides blood red Malabar Coast' may safely be taken as the type.

South of this the bird becomes far more common. There is no accurate account of its status in Mysore but, at Manzeerabad, Macgregor (*S. F.* x. 462) obtained one specimen and at Bangalore Bates found it exceedingly common, though Davison did not meet it in S. Mysore below the Nilgiris. From here it evidently extends over into our area on the Eastern Ghats near Palmaner, where Bates found it on the Munar Ghat.

It occurs in Coorg and Malabar and in the Wynaad it is very common. On the slopes of the Nilgiris it is less common but it occurs up to 5,000 ft. Although very common in the Nelliampathis, and in Travancore from the foot of the hills up to about 5,000 ft., it is curiously absent from the Palnis.

The ordinary breeding season in all parts of the range is apparently from February to April, but Baker quotes Stewart to the effect that in Travancore there is a second brood about August. Both in Travancore and in the Nelliampathis (Bourdillon *S. F.* iv, 402 ; Kinloch *J. B. N. M. S.*, xxix, 294) this magpie is said to associate habitually with *Dissemurus paradiseus* and further information on this point and the reason for the association is most desirable.

Dendrocitta formosae sarkari Kinnear and Whistler.

Dendrocitta formosæ sarkari Kinn. and Whistler, *Bull. B. O. C.*, LI (cccxliv) 1930 (October), p. 17.—Anantagiri, Vizagapatam.

Specimens collected :—1325 ♂ 5-2-30, 1377 ♂ 12-2-30, 1390 ♂ 14-2-30, 1418 ♀ 20-2-30, Anantagiri 3,000 ft. ; 1690 ♂ 16-4-30, 1696 ♂ 17-4-30, 1708 ♂ 19-4 30, Jeypore agency 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
6 ♂	33–34	136·5–144·5	201–214	28–30 mm.
1 ♀	32·5	142·5	200	28 mm.

Long ago Jerdon wrote that the Himalayan Tree-Pie ' occurs very rarely on the hills of Southern India. I got a specimen said to have been killed on the Eastern Ghats and fancied that I saw it on the Segoor Pass of the Neilgheiries. Horsefield also had one specimen from Madras.'[1] (*B. of I.* ii, 316). This statement was however discredited by W. Davison (*S. F.* x. 399) and Hume lent the weight of his authority against it. The possibility of its occurrence in the Peninsula was accordingly disregarded in both editions of the *Fauna*.

Great interest therefore attaches to La Personne's rediscovery of this bird in the Vizagapatam district where he procured a good series at Anantagiri and Jeypore at elevations about 3,000 ft. His note is as follows :—'Common throughout the area under survey in Vizagapatam but not extending beyond the hill tracts. Their call was at once reminiscent of the Himalayan bird. During the months February, March and April these birds were in various stages of genital development and courtship. They were to be found in rather large numbers feeding principally on the flowers of *Bombax malabaricum*.'

These birds differ from the typical form (E. Himalayas) in the much smaller beak 33–34 mm. as compared with 36·5–38·5 mm. *D. f. occidentalis* (Western Himalayas) is an altogether larger bird, wing in ♂ 145–160 mm.

Parus major mahrattarum Hartert.

Specimens collected : 385 ♂ 12–6–29, 407 ♀ 14–6–29, 417 ♀ 419 ♀ juv. 15–6–29 Chitteri range 3,000 ft. ; 963 ♀ 3–11–29, Nallamalai range 2,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	11	67	59·5	18 mm.
3 ♀	11–12	62–68	51–58	17·5–18 mm.

The Grey Tit appears to be scarce on the eastern side of the Presidency. There is no actual record north of the Nallamalais where La Personne procured the above specimen and south of that he only met with in the Chitteri range, commenting specially on its absence elsewhere.

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[1] Cf. Horsf. and Moore, *Cat. Mus. H. E. I. Co.* ii, p. 569 ' from Wright's collection.'

In the West we know more about it. In Travancore it is confined to the hills and is not uncommon, being found at all altitudes from the base to 6,000 ft. but most numerous at 3,000 ft. In the Nalliampathis Kinloch says it is rare. In the Palnis Fairbank did not meet with it but Terry found it in the Pittur valley (*S. F.* x. 478).

Northwards it occurs all over the Nilgiris, the Wynaad and Coorg, being especially abundant near habitations on the higher ranges of the Nilgiris.

In the Nilgiris the Grey Tit breeds from February to May, and Miss Cockburn records a nest with young as late as 10th November. There is no other information on record for the presidency beyond the fact that in June in the Chitteri range the season was evidently ending. The juvenile obtained agrees with two others in the British Museum (Ahmednagar, Fairbank; Ootacamund, Gosse.) and one obtained by Dr. C. B. Ticehurst at Nasik in having the upper plumage tinged with green and the lower parts faintly washed with yellow. Another juvenile in the British Museum from Ceylon however differs in having no green or yellow tints in the plumage while the upper parts are darker than in the adult. This is probably only an individual variation as although juveniles of *caschmirensis*, *nepalensis* and *cinereus* (E. Java) examined betray their origin in the major group by possessing the green and yellow tints, two other juveniles of *cinereus* from Flores and Alor (Moluccas) are duller replicas of the adults as in the Ceylon bird.

Ticehurst (*J.B.N.H.S.* xxxi. 491) and Whistler (*Bull. B.O.C.*, vol. L, p. 6, 1929) both objected to the arrangement of the Grey Tits of India in vol. i, of the *New Fauna* and their emendations were accepted in vol. vii p. 12. We are however of opinion that no arrangement is satisfactory which combines the Grey Tit of Bihar, Bengal and Assam with that of Java and the neighbouring Islands. The group is a difficult one but on series we think there should be no objection to upholding the following races in India on the distinctions indicated :—

A. Larger and paler forms.

Parus major caschmirensis Hartert.

Parus major caschmirensis Hartert, Vogel P. F., vol. i, (June 1905), p. 345—Gilgit.

(*a*) Grey predominates on central tail feathers.
(*b*) Blue fringes of greater coverts broad so that coverts appear blue.
(*c*) White wedge on inner web of penultimate tail feather very long, 20–45 mm., almost always over 30 mm.
(*d*) Outer web of penultimate tail feather practically entirely white.

	Bill.	Wing.	Tail.	Tarsus.
27 ♂	12–13	72–78	60·5–71	17–20·5 mm.
18 ♀	11·5–13	68·5–73·5	56–62·5	18–20 mm.

N.-W.F. Province, Kashmir and Western Himalayas, visiting Punjab and Western United Provinces in winter.

Parus major ziaratensis Whistler.

Parus major ziaratensis Whistler *Bull B.O.C.* vol. L, No. cccxxv (October 1929), p. 6, Ziarat, Baluchistan.

Details as in *caschmirensis* but differs in the slightly paler bluer grey of the upper parts, the greater amount of white edging on the tertiaries and in the smaller stumpier bill.

	Bill.	Wing.	Tail.	Tarsus.
7 ♂	11–12	73–78	62·5–71 mm.	(not noted).
2 ♀	11·5	70·5–71·5	60 mm.	

Ziarat, Baluchistan; Kandahar, Afghanistan.

B. Smaller and darker forms.

Parus major nipalensis Hodgson.

Parus nipalensis Hodgson, *Ind. Rev.* 1838, p. 31—Nepal.

(*a*) A wide band of black along shafts of central tail feathers, remainder grey.
(*b*) Blue fringes of greater coverts broad so that coverts appear blue.
(*c*) White wedge on inner web of penultimate tail feather 12–38 mm. usually over 25.

(*d*) Always a black line on white outer web of penultimate tail feather.

	Bill.	Wing.	Tail.	Tarsus.
5 ♂	11·5-12	67-68	59·5-61	16·5-17·5 mm.
2 ♀	11·5-12	62·5-65	54	17 mm.

Lower Nepal, Bihar, Bengal, Duars and Assam.

Parus major mahrattarum Hartert.

Parus major mahrattarum Hartert, *Nov. Zool.*, vol. xii (September 1905) p. 499—Ceylon.

(*a*) Central tail feathers black, a line of grey down the outer web.

(*b*) Blue fringes of greater coverts narrow, so that coverts appear black with blue edges.

(*c*) White wedge on inner web of penultimate tail feather 6·5–34 mm., usually over 25.

(*d*) Sometimes a black line on white outer web of penultimate tail feather.

	Bill.	Wing.	Tail.	Tarsus.
18 ♂	10–12·5	62–73·5	51–60·5	16·5–19 mm.
7 ♀	10·5–12	61–68	48·5–58	15·5–18 mm.

India south of and including Mt. Abu, Central Provinces and Orissa ; Ceylon.

In order to show why we have separated ***P. m. nipalensis*** we enumerate the corresponding points of.

Parus major cinereus Vieillot.

Parus cinereus Vieillot, Nouv. Dict. d'Hist. Nat., nouv. ed. vol. xx, (1818), p. 316 ex Levaillant pl. 139, fig. 1—Batavia.

(*a*) A narrow band of black along shafts of central tail feathers, remainder grey.

(*b*) Blue fringes of greater coverts narrow, so that the coverts appear black with blue edges.

(*c*) White wedge on inner web of penultimate tail feather small, 2·5–23 mm., usually under 20.

(*d*) Outer web of penultimate tail feather black, except for a white tip.

There appears to be no difference in size.

[**Parus nuchalis** Jerdon.

Parus nuchalis Jerdon, *Madras Jour. Lit. Sci.* xiii (1845), p. 131—Eastern Ghats.

Jerdon obtained his type of the White-winged Black Tit 'from the Eastern Ghats, west of Nellore' where it was said by the shikaris who produced it to be very rare. It is difficult not to feel that there must be some mistake (in spite of the further statement by Jerdon that it had since been obtained by Dr. Stewart at Bangalore) when a bird which is definitely known to be characteristic of the dry country of Rajputana is recorded on native testimony from the densely wooded and moist Eastern Ghats. Jerdon's and Stewart's specimens apparently no longer exist and Hume was inclined to think that when rediscovered, the bird of the Eastern Ghats would prove distinct from that of Rajputana. Unfortunately the Survey has thrown no light on the point.]

Machlolophus xanthogenys aplonotus (Blyth).

Specimens collected : 1320 ♀ 4-2-30, 1334 ♂ 6-2-30, 1348 ♂ 7-2-30, 1378 ♂ 12-2-30, 1383 ♂ 1385-6 ♂♂ 13-2-30, 1397 ♀ 16-2-30, 1398 ♂ 17-2-30, 1432 ♂ 21-2-30, 1434-5 ♂ ♀ 23-2-30, Anantagiri 3,000 ft.; 1471 [♀] 4-3-30 Sankrametta 3,500 ft.; 1692 ♂ 17-4-30, 1728 ♂ 26-4-30 Jeypore agency 3,000 ft.; 1752 ♂ 2-5-30, 1774 ♂ 5-5-30 Anantagiri 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
13 ♂	12–13	70·5–77·5	54–60	18 –19·5 mm.
4 ♀	12–12·5	70 –71	52–53	18·5–19 mm.

The Yellow-cheeked Tit is widely spread in Peninsula India, chiefly as a bird of the elevated plateau and hill ranges, and this area is separated from that of the typical race (Western Himalayas) by the great Gangetic plain. The Peninsula birds have hitherto been treated as belonging to one race but an examination of the material shows that this is not correct.

If birds from Travancore are compared with those from Mt. Abu (i.e. from the extremities of the Peninsular distribution) it is at once evident that they are different. The former differ from the latter in (1) the larger size ; (2) the duller more saturated green of the upper plumage as compared with bright yellow green ; (3) the duller darker blue edging to the wings, the marked reduction of the white tips of the tertiaries, and the smaller white spots on the median and greater wing coverts ; (4) the duller and more olive green colour of the yellow parts of the lower plumage.

The following table shows comparative measurements of the three forms, males only, and explains also why previous writers have disagreed as whether *aplonotus* (in which they included both northern and southern birds) was the larger than *xanthogenys* or not.

	Bill.	Wing.	Tail.	Tarsus.
xanthogenys	12 –12·5	71·5–76	54·5–60	18–19·5 mm.
aplonotus	12 –13	70·5–77·5	54 –60	18–19·5 mm.
Southern birds	12·5–14	76·5–82·5	57·5–62·5	19–19·5 mm.

As in other birds of Peninsula India there is a gradual passage from one form to the other. After a careful comparison of the survey series and other material available we consider that all specimens from the Konkan southwards should be grouped together and all Peninsula birds from Mahableshwar northwards should form another group to which belong the survey series from Vizagapatam district. To the latter group the name *aplonotus* rightly belongs.

We have considered whether *Parus jerdoni* Blyth, *J.A.S.B.* xxv (1856), p. 445, could be used for the southern race. The type apparently does not exist. Blyth said that his specimen was amongst a collection of birds sent on inspection by Dr. G. Buist on behalf of the Bombay branch of the Asiatic Society but no hint was given of the actual locality. The description is not clear enough to refer conclusively to either race and in any case Blyth was thoroughly confused over these Tits (*vide* Hume *S. F.* vii, p. 405 foot-note). We have therefore thought it desirable to name it as

Machlolophus xanthogenys travancoreensis subsp. nov.

Type ♂ 12 Nov. 1878, Mynall, Travancore (Bourdillon). Brit. Mus. No. 80-8-19, 109.

The races will therefore stand as follows :—

Machlolophus xanthogenys xanthogenys (Vigors).

Parus xanthogenys Vigors *P.Z.S.*, vol. i (1831, Feb.), p. 23—Himalayas, Simla—Almora district.[1]

Western Himalayas from Murree to Nepal (but apparently not Sikkim as usually stated). Breeding about 5,000 ft. to 7,000 ft.

Machlolophus xanthogenys aplonotus (Blyth).

Parus aplonotus Blyth, *J.A.S.B.* xvi (1847), p. 444—Chaibasa, Singhbhun.

Mt. Abu: Parisnath Hill: locally at all elevations in the Central Peninsula from Mhow, Saugor and Orissa down to a line from Poona to the Godavery valley.

Machlolophus xanthogenys travancoreensis Kinnear and Whistler. subsp. nov.

The Western Ghats and neighbouring wooded areas from S. Konkan to the Asambo Hills, at all elevations.

When the contact zone of *M. xanthogenys* and *M. spilonotus* in Nepal is understood we suspect that *M. s. spilonotus* (E. Himalayas and Assam) and *M. s. subviridis* (Burma and Tenasserim) will prove to be also races of *M. xanthogenys.*

In the Madras Presidency *M. x. aplonotus* (as above defined) is only found in the extreme north. The Survey met with it in the Vizagapatam district whence La Personne notes :—'Extremely common around Anantagiri and extending well into the interior. Absent from the plains. Not quite so numerous in the Padwa Valley but I believe these Tits are common in the hill tracts of Koraput and Jeypore. Breeding during the latter end of April, a nest being found in a coffee plant. These Tits feed chiefly on the flowers of *Bombax malabaricum* in company with *Zosterops*, *Sitta* and *Phylloscopus*. I have seen them chase and devour flying ants.'

A male from Jeypore 4th March 1877 (Hume Coll.) is the only other known record for our limits. The bird is strictly a resident.

The breeding season is not easy to define but in the north of Peninsula India it is apparently from April to August, whilst about Poona it is certainly later from July to October as in *travancoreensis.*

The series collected by La Personne introduce an interesting problem with regard to the plumages of the Tits of this genus. The fifteen males all agree in being black crested and in having a broad longitudinal black band from the

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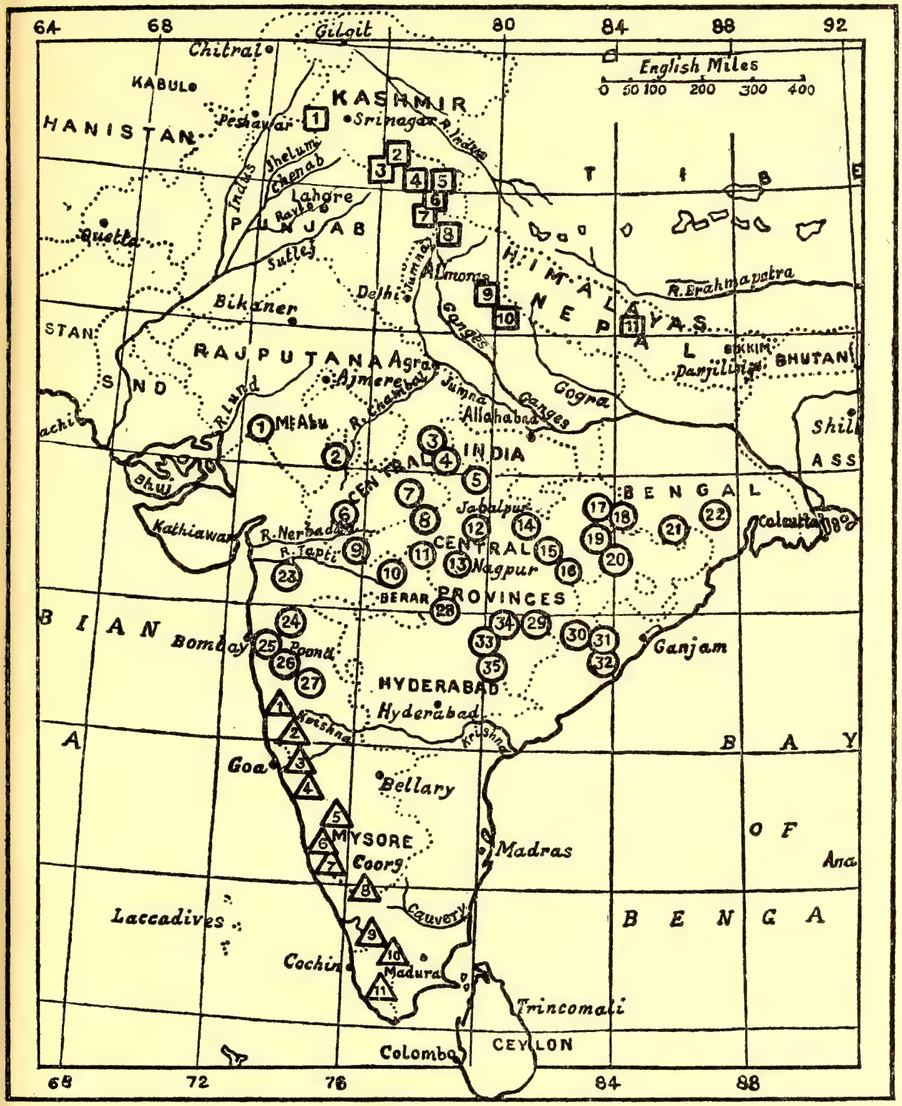
[1] *Ibis*, 1924, p. 471.

MAP TO ILLUSTRATE THE DISTRIBUTION OF THE RACES OF *MACHLOLOPHUS XANTHOGENYS*.


64
68
80
84
88
92
Chitral
Gilgit
KABUL
KASHMIR
Srinagar
R. Indus
HANISTAN
Peshawar
Indus
Jhelum
Chenab
Lahore
R. Ravi
PUNJAB
Quetta
Sutlej
Jumna
Almora
Delhi
Bikaner
HIMALAYAS
NEPAL
R. Brahmapatra
TIBET
SIKKIM
Darjiling
BHUTAN
English Miles
0 50 100 200 300 400
STAN
RAJPUTANA
Agra
Ajmere
SIND
R. Luni
Mt. Abu
R. Chambal
Ganges
Jumna
Allahabad
Gogra
Ganges
CENTRAL INDIA
Bhuj
Kathiawar
R. Nerbadda
R. Tapti
Jabalpur
CENTRAL PROVINCES
Nagpur
BENGAL
Calcutta
Shill
ASS
BERAR
BIAN
Bombay
Poona
HYDERABAD
Hyderabad
Ganjam
A
Krishna
Krishna
Goa
Bellary
BAY OF BENGAL
MYSORE
Coorg
Madras
Ana
Laccadives
Cauvery
Cochin
Madura
Trincomali
Colombo
CEYLON
68
72
76
84
88
1 2 3 4 5 6 7 8 9 10 11
1 2 3 4 5 6 7 8 9 10 11
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

MACHLOLOPHUS X. XANTHOGENYS.

Numbers in square brackets.

1. Murree
2. Chamba
3. Dalhousie
4. Dharmsala
5. Kulu
6. Koteghar
7. Simla
8. Mussoorie
9. Naini Tal
10. Ranikhet
11. Nepal Valley

MACHLOLOPHUS X. TRAVANCOREENSIS.

Numbers in triangular brackets.

1. S. Konkan
2. Belgaum
3. Castle Rock
4. N. Kanara
5. Mauzeerabad
6. Coorg
7. Wynaad
8. Nilgiris
9. Nelliampathies
10. Palnis
11. Travancore

MACHLOLOPHUS X. APLONOTUS.

Numbers in round brackets.

1. Mt. Aboo
2. Neemuch
3. Jhalawar
4. Goona
5. Saugor
6. Mhow
7. Sehore
8. Pachmarhi
9. Satpuras
10. Melghat
11. Chikalda
12. Beetul
13. Nagpur
14. Moti Nala, Majgon, Kapa
15. Balaghat
16. Raipur
17. Sirguja
18. Jashpur
19. Udaipur
20. Sambalpur
21. Chaibasa
22. Parasnath
23. W. Khandesh
24. Egutpura
25. Lanoli
26. Poona
27. Mahableshwar
28. S.-E. Berar
29. Bastar State
30. Jeypore
31. Sankrametta
32. Anantagiri
33. Wardha Valley
34. Pranhita
35. Yenchapali

chin to the vent. This is usually described as being the adult plumage common to both sexes. The three females on the other hand (and an unsexed bird agreeing with them) differ in having the black band replaced by dull olive green. It is evident therefore that either the sexes differ or the bird takes a year to assume the adult plumage. Either explanation is unusual in the *Parinæ*.

Examination of the large series in the British Museum has not settled the problem owing to the scarcity of juvenile birds and the fact that the sexing of all specimens is not reliable. Both green and black banded specimens are found in other parts of the range but the only juvenile which we have been able to examine (5-8-1868 Mt. Abu, King) although marked ♀ agrees with the adult ♂ in being black banded and black crested. A first winter ♂ still retaining the juvenile wing coverts (16-10-1911, Nagpur : Central Mus. Col. No. 165) is black banded.

An examination of the series of *travancoreensis*, only makes the puzzle more complete. In this area we find not only the black and green banded forms, both with a black crest but also a third type of apparently mature bird. This is green banded but has the crest also green like the colour of the back, the feathers centred with blackish shaft stripes. The black on the lores of *travancoreensis* and the broad black line through the ear coverts are replaced by dark green slightly darker than the green of the back. There are six specimens of this type in the British Museum, viz. :—

♀ 31-4-67	Ootacamund	Hume Coll.	♂ 10-12-74	Mynall	Bourdillon.
♀ 20-4-69	Nilgiris	Theobald	o ?	'Malabar'	Tweeddale Coll.
♀ 19-4-69	Coonoor	Carter	o ?	'India'	Jerdon.

Although these specimens have always been passed over as a stage of plumage of the species under review we cannot fit them into the known facts and it is not impossible that they represent an overlooked species from the rain forests of the S. W. of India. But we hesitate so to describe them until the plumages of the *xanthogenys* group are fully understood.

From the area of *travancoreensis* 3 juveniles exist, one in the British Museum marked ♂ Coonoor 28-8-76 (Wardlay-Ramsay) and two, unsexed, in the Whistler collection (22-12-01, Sigur Ghat, H. R. Baker). All agree in being dull versions of the black crested, green banded plumage.

We suspect that the Coonoor bird is wrongly sexed and that *travancoreensis* and *aplonotus* agree in having the sexes different, the juveniles of the two sexes agreeing with the respective adults. Examination of other members of the genus does not throw light on the matter as there is evidently no uniformity. In *xanthogenys xanthogenys* the sexes are alike and four juveniles examined agree with the adults. In *spilonotus spilonotus* the female differs from the male in a marked restriction of the amount of black on the chin and throat and the black is apparently never replaced by olive green. In *spilonotus subviridis* on the other hand the adult male and female are alike, but in both sexes in the first winter plumage the black band is replaced by dull olive green.

The correct solution of these difficulties must be left to workers in the field. Careful dissection of a few specimens will soon settle the matter.

Machlolophus xanthogenys travancoreensis

This south-western race of the Yellow-cheeked Tit is common in the western side of the Presidency, but it was not met with by the Survey. It is a common member of hunting parties of small insectivorous birds in Coorg and the Wynaad, right through to the Nilgiris. It does not ascend to the plateau or above 6,000 ft. in the Nilgiris, there occupying a lower zone than *Parus major mahrattarum*, a curious reversal of the zones of the respective races of these two Tits in the Western Himalayas.

In the Nelliampathis it is extremely common, though apparently less so in the Palnis. In Travancore it is said by Bourdillon and Ferguson to be a high elevation bird, abundant from 3,000 ft. upwards.

Evidently a late breeder from July to August and possibly even later.

Sitta castanea castanea Lesson.

The typical form of the Chestnut-bellied Nuthatch is confined in the Presidency to the western side. Birds from this area are not separable from those of the north. Although it occurs in the Wynaad and Malabar, round the base of the Nilgiris and in the Palghat hills it nowhere appears to be as numerous in our area as it is in northern India. Nothing is recorded about the breeding season in this area.

Sitta castanea prateri subsp. nov.

Specimens collected : 1325 ♂ 5-2-30, 1366 ♂ 10-2-30, 1413-4 ♂ ♀ 20-2-30, 1429 ♀ 22-2-30, 1433 ♂ 23-2-30, 1443 ♀ 26-2-30 Anantagiri 3,000 ft. ; 1536 ♀ 14-3-30, 1679 ♀ 12-4-30 Sankrametta 3,500 ft. ; 1725 ♂ 24-4-30, 1746 ♀ 29-4-30 Jeypore agency 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
5 ♂	21–22	77·5–82	40·5–43	17–18·5 mm.
6 ♀	20–22	75–78·5	38–41	17–18·5 mm.

This Nuthatch, which Jerdon had already recorded as common in Gumsoor and the Northern Circars, was found by La Personne to be common throughout the hills of the Vizagapatam district where it was evidently breeding, chiefly at 3,000 ft. Birds were observed carrying food as early as 3rd March. They were not met with in any of the other collecting camps. The good series collected are very uniform in size and colour and differ from *Sitta castanea castanea* in their longer bills, in the paler underparts of the ♂ and in the colour of the lower tail coverts which are ash-grey with narrow pale subterminal bands and chestnut fringes. As the large series of the typical form examined from the rest of the Peninsula are remarkably constant in size and colour, we have no hesitation in accepting this race from the upper Eastern Ghats, and, in its name, have much pleasure in recognizing Mr. Prater's great services to Ornithology. Topotypes of this common species cannot be traced in any collection but we have no reason to think that Bengal birds differ from those of the rest of the Indo-Gangetic plain.

The Indian races of this species will stand as follows :—

Sitta castanea almoræ Whistler.

Sitta castaneoventris almoræ Whistler, *Bull. B.O.C.* li, (Nov. 1930), p. 27—between Pethora and Almora.

Beak very heavy, underparts in ♂ cinnamon brown, under tail coverts ash-grey with broad white subterminal patches and cinnamon fringes.

Western Himalayas.—

	Bill.	Tail.	Wing.	Tarsus.
7 ♂	21·5–23·5	84–87	40–44	18–20 mm.
5 ♀	21–24	79–85	40–43·5	18–19·5 mm.

Sitta castanea cinnamoventris Blyth.

Sitta cinnamoventris Blyth, *J.A.S.B.* vol. xi (1842), p. 459—Darjeeling.

Beak very heavy, underparts in ♂ chestnut brown, in ♀ slightly richer than in last, under tail coverts as last but fringes chestnut. Nepal and Eastern Himalayas to Assam.

	Bill.	Wing.	Tail.	Tarsus.
13 ♂	19–23·5	81–86·5	38·5–45 :	18–20 mm.
7 ♀	18–21·5	77·5–82	38–41	17–18·5 mm.

Sitta castanea castanea Lesson.

Sitta castanea Lesson, Traité d'Orn., 1830 (Sept. 25), p. 316—Bengal.

Beak fine and short. Underparts in ♂ deep chestnut brown, darker than in the last. Under tail coverts ash-grey with chestnut fringes. India. Generally but only locally distributed.

	Bill.	Wing.	Tail.	Tarsus.
20 ♂	18–20·5	72–81	36–41	16–18·5 mm.
15 ♀	18–20·5	71·5–78	35·5–38·5	16–18 mm.

Sitta castanea prateri Kinnear and Whistler.

Beak medium sized. Underparts in ♂ as *c. cinnamoventris*. Under tail coverts ash-grey with narrow pale subterminal bands and chestnut fringes.

The underparts of the females of *c. castanea* and *c. prateri* are paler and pinker in colour than in the other two races.

	Bill.	Wing.	Tail.	Tarsus.
5 ♂	21–22	77·5–82	40·5–43 :	17–18·5 mm.
6 ♀	20–22	75–78·5	38–41	17–18·5 mm.

Sitta frontalis frontalis Swainson.

Sitta frontalis Swains., Zool. Illus., Ser. i, pt. i, 1820 (1st October), pl. 2—Ceylon.

Specimens collected: 225 ♂ 15-5-29, 267-8 ♂♂ 23-5-29 Shevaroy Hills, 3,500 ft.-4,000 ft.; 401 ♀ 13-6-29 Chitteri Hills 3,000 ft.; 1370 ♂ 11-2-30, 1438 ♂ 25-2-30, 1,444 ♀ 26-2-30 Anantagiri 3,000ft.; 1470 ♂ 4-3-30, 1,584 ♀ 23-3-30 Sankrametta 3,500 ft.

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
6 ♂	15–16	71·5–78·5	39–43·5	15–16·5 mm.
3 ♀	14·5	71·5–74	36–41·5	15–15·5 mm.

There has been some confusion over the type locality of this species which in the *Fauna*, vol. i, p. 132 is given as Java and in vol. viii, p. 25 as Ceylon. The latter is correct as explained in *J.N.H.S.* Siam vol. v, pt. 3, 334 (1924).

The distribution given for this species in India in the *Fauna* is perhaps too sweeping—'the whole of India east[1] of Bombay, Gwalior and Kumaon' It is found on the mountain ranges of the Western Ghats from about Khandesh to the extreme south of Travancore; on the Shevaroys; in the hilly country from Dholbhum to Vizagapatam; and in the submontane valleys of the Himalayas from Kumaon eastwards. Apart from these areas, I can trace only isolated records for Gwalior and Saugor and Betul district, C.P. The bird is certainly not generally distributed.

Careful examination of all available material confirms Ticehurst's statement (*J.B.N.H.S.*, xxxi, 491) that Himalayan birds are smaller than the typical race and should be separated as *S. f. corallina* Hodgson, *J.A.S.B.*, v (1836), p. 779—Nepal.

	Bill.	Wing.	Tail.
7 ♂ Sikkim	14·5–16	72–76·5	38·5–40 mm.
3 ♀ ,,	14	70–72	38 mm.

Birds from the Nilgiris, Palnis and Travancore agree with those from Ceylon and measure as follows:—

	Bill.	Wing.	Tail.
3 ♂ Ceylon	16–16·5	76–77	39·5–41 mm.
19 ♂ Nilgiris Palnis Travancore	15·5(2),16·5–17·5	77–83·5	39·5–46 mm.
3 ♀ Ceylon	16–17	72·5–79	38·5-41 mm.
10 ♀ Nilgiris, etc.	15(1),16–17	74·5–83·5	39–45·5 mm.

As measurements alone distinguish the races and intergradation occurs in the few specimens available from the range of the bird between the Nilgiris and the Himalayas it will be convenient to consider all birds south of the Indo-Gangetic plain as belonging to the typical race; whilst the small Himalayan form extends through Burma to Java.

In the presidency the Velvet-fronted Nuthatch is widely distributed as a resident hill bird though its range on the eastern side is not properly known. Jerdon met with it in Gumsoor, and in the Vizagapatam district, La Personne found it common everywhere about 3,000 ft. It has not been yet recorded between there and the Shevaroy Hills and Chitteri Hills where it is common about 3,000 ft.–4,000 ft.

It is common throughout the S.W. group of ghats, the Nelliampathis, Palnis and Travancore Hills, apparently at all elevations, growing commoner above 2,000 ft.

In the Nilgiris it reaches its greatest degree of abundance spreading from there through the Wynaad, Coorg and the forests of the Malabar coast.

The breeding season in the presidency is from February to April and appears to be well defined.

Garrulax delesserti (Jerdon).

Crateropus delesserti Jerdon, *Madras Jour. Lit. Sci.* x, 1839 (December), 256.—Kotagherri.

The Wynaad Laughing Thrush is peculiar to the Western Madras Presidency. It is found, but not very commonly, in the Brahmagiris, the Wynaad, and on the slopes of the Nilgiris down to the Palghat hills. South of the Palghat gap it is found in the Nelliampathy Hills and southwards throughout the whole of the Travancore hills at all elevations; in this area it is apparently far more common. Curiously enough however it does not occur in the Palnis so far as is known.

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[1] By a slip printed as west.

Ferguson states that in Travancore it breeds in June. Stuart-Baker however says of Travancore 'the breeding season is March to May, but Mr. Stuart has taken eggs in February and again in August'. There is no information for the other parts of its range.

Trochalopteron cachinnans (Jerdon).

Crateropus cachinnans Jerdon, *Madras Jour. Lit. Sci.* x, 1839 (December) 255 Nilgiris.

Confined to the Nilgiris where it is exceedingly common at all elevations above 4,000 ft. The Nilgiri Laughing Thrush breeds from February to June and occasional nests may be found with eggs in July.

Trochalopteron cachinnans cinnamomeum Davison.

Trochalopteron cinnamomeum Davison, *Ibis*, 1886, 204 (locality unknown).

Nothing is known of this bird beyond the fact that Davison discovered two specimens of it in the Museum at Trivandrum, Travancore which were said to have been brought from the west coast of India, though the actual locality was never verified. The Palghat Hills have been suggested. We cannot help thinking however that the colour of the specimens is due to stain and that there is really no subspecies of this bird.

Trochalopteron jerdoni jerdoni (Blyth).

Garrulax (?) *jerdoni* Blyth, *J.A.S.B.*, xx (1851), 522 no locality—Banasore Peak.

Peculiar to the Madras Presidency. Jerdon obtained the type at about 5,000 ft. 6,000 ft. at the top of the Banasore Peak, a high hill at the edge of the ghats separating Malabar from the Wynaad (*B. of I*, ii, 50). Later, Davison obtained a series of 12 specimens from the Bramagherry Hills in Coorg which are about 20 miles away from Banasore (Balasore) and in sight of it. These remain the only authentic records of what must be considered one of the rarest birds of India.

R. W. Morgan (*S. F.* ii. 532) considered that he had met with the Banasore Laughing Thrush on the Palghat Hills and the Chinnaconoor Ghat of the Nilgiris, but it is by no means certain that he did not really observe one of the other allied forms.

Trochalopteron jerdoni fairbanki. Blandford.

Trochalopteron fairbanki Blanford, *J.A.S.B.* (1869) xxxviii, pt. 2, p. 175—Palni Hills.

Confined to the Madras Presidency. In the first edition of the *Fauna*, Oates gave the range of this bird as 'the Palnis and Anamulli Hills in South Travancore above 3,000 ft.' This was very misleading as pointed out by Ferguson (*J.B.N.H.S.*, xv, 257) but unfortunately the second edition of the *Fauna* did not profit by the correction.

In *Southern* Travancore it is not found at all. It is common in *North* Travancore at 5,000 ft. and upwards on the Kanan Devan Hills, or High Range, the highest peak of which, Anaimudi, is the centre from which spring the Palnis and Anamallais, where it is also common. These two ranges are not in Travancore but in British Territory.

A specimen in the Bombay collection was obtained by Prater on 15-5-17 in the High Wavy Mountains of Madura.

The breeding season is from April to June.

The change of the trivial name in the new *Fauna* from Palni to Travancore Laughing Thrush is probably a slip. It is at any rate undesirable. A very good account of its habits and nidification by Capt. R. S. P. Bates will be found in the *Journal*, vol, xxxv, pp. 204-7.

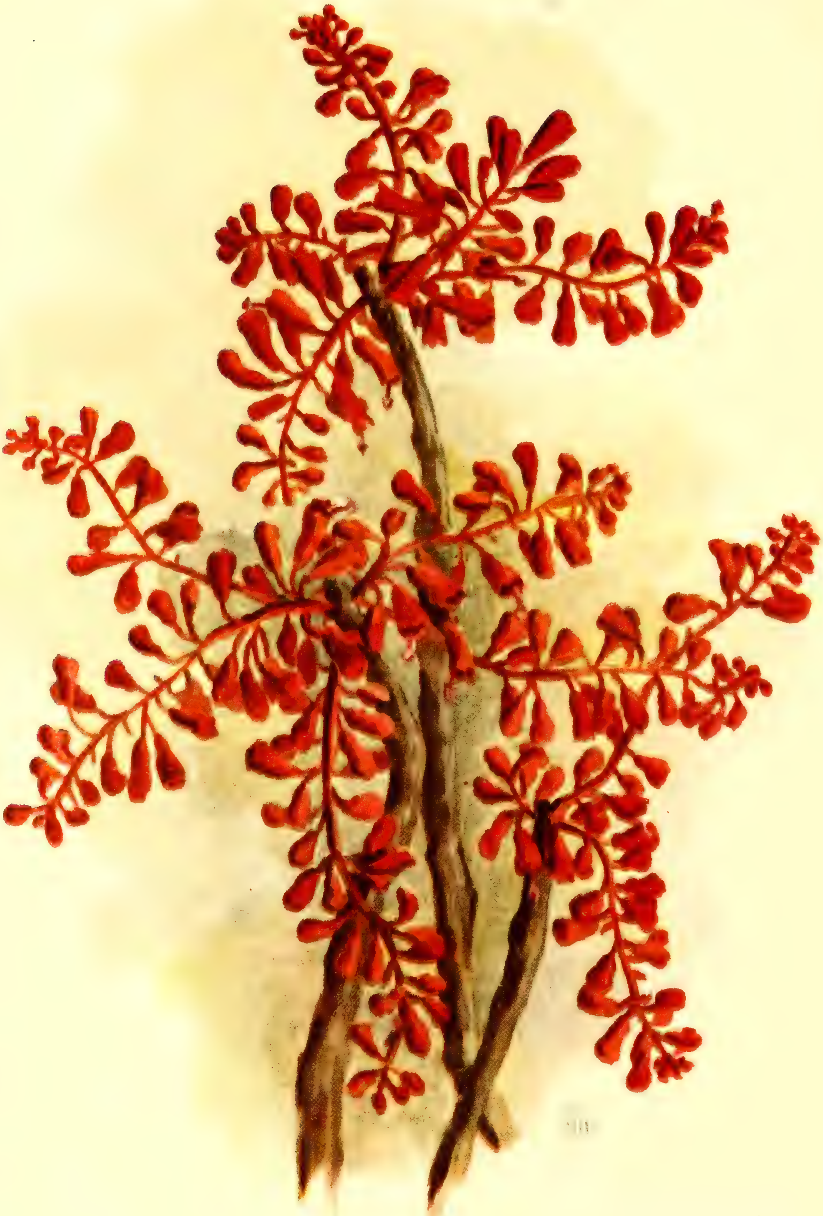
Trochalopteron jerdoni meridionale. Blanford.

Trochalopterum meridionale Blanford, *Proc. As. Soc. Bengal*, 1880 (November), p. 184—S. Travancore Hills [Mynall].

Peculiar to the Madras Presidency. Here again the *New Fauna* (i. p 179) is at fault in the distribution. It does not occur in *North* Travancore as stated but is confined to the summits of the hills above 3,500 ft. in *South* Travancore up to and including the Achankovil gap (Autchincoil gap of the *Fauna*).

The breeding season is not recorded.

(*To be continued.*)



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THE COLOURED STERCULIA.
Sterculia colorata, Roxb.
(about ½ nat. size).

SOME BEAUTIFUL INDIAN TREES.

BY

E. BLATTER, S.J., Ph.D., F.L.S., AND W. S. MILLARD, F.Z.S.

PART VIII.

(*With two coloured and two black and white plates and 6 diagrams.*)
(*Continued from page 296 of this volume.*)

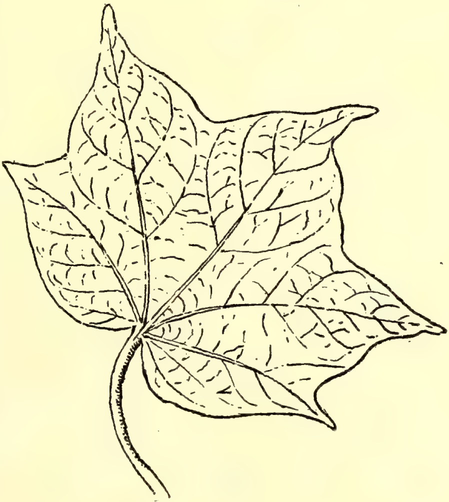
THE COLOURED STERCULIA

Popular Names: Bodula, Walena, Samarri (Hind.); Mula (Beng.); Khowsey, Pinj (Berar); Pisi, Sisi (Kol.); Bolazong (Garo); Sitto udal, Phirphiri, Omra, (Nepal); Kanhlyem (Lepcha); Bodala, Bodal (Kumaon); Mutruk (Merwara); Lersima (Kharawar); Bhai-koi, Khowsey, Bheckhol, Samarri, Walena (Bomb.); Karaka, Karu boppayi (Tel.); Wet-shaw, Yaseng-shaw (Burm.); Berda (Andaman).

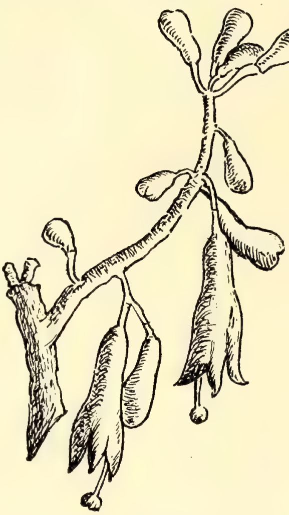
Sterculia colorata Roxb. Hort. Beng. (1814) 50. By some called *Firmiana colorata* R. Br. (*Sterculiaceæ*).

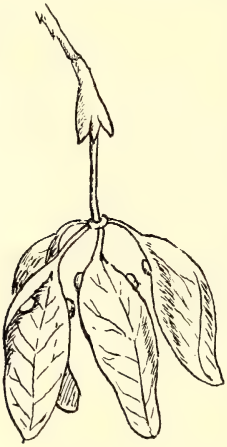
(*Sterculia* from Sterculius of Roman mythology, derived from *stercus*, dung. The Romans in the height of paganism deified the objects of their greatest dislike and most immoral actions. Thus they have the gods Sterculius, Crepitus, and the goddesses Caca and Petunda. The flowers and leaves of some species of Sterculia are ill-smelling. *Colorata* means coloured, referring to the orange-red calyx.)

A very conspicuous tree when in flower from March to May. The tree is leafless at this period and the branches and twigs are covered with coral-red flowers and as these fade, their place is taken by the winged leaf-shaped follicles which are pink at first and turn red later. These bear on the edges one or two seeds. The tree is fairly common at Khandalla on the Western Ghats and there used to be a few trees growing in Bombay fairly recently.



Description: A large tree with a straight, sometimes fluted trunk covered with thick, scaly, ash-coloured bark and a crown of spreading branches. The leaves are crowded together at the ends of the branches. They grow on slender stalks from 4″–12″ long. The leaf is broader than long; it measures 4″–8″ in length and is from 5″–12″ in width. It has 3–5 points formed by shallow triangular lobes which taper acutely towards the tips. In the older trees the number of these lobes is usually three, but in the younger plants and seedlings, the number of points is increased. Young leaves and shoots are always downy. The older leaves are smooth on both surfaces, but this is a character which differs in different localities. There are varieties of this tree in which the under-surface of the old leaf is hairy. The tree commences to shed its leaves in November and is leafless from January to April, when the young leaves commence to sprout. This generally takes place after the tree has burst into flower. The Coloured Sterculia is then a conspicuous and brilliant sight. In the forests of the Western Ghats and the Deccan where the tree is common, these trees in flower appear on the hill sides and in the ravines like masses of flaming red coral. The flowers grow in short dense panicles at the ends of the branches. Their colour varies from bright coral or orange-red to greyish brown. The stalks, the flowers and the stem on which they grow are covered with fine downy hairs, giving the whole inflorescence a soft, velvety appearance. The calyx of the flower is funnel-shaped. The petals form a long, lobed tube from which the column of the stamen protrudes, bearing at its summit about 30 yellow anthers. The style is short and recurved. The interior of the flower is deep red. The fruits are numerous and conspicuous and might be mistaken for leaves. The fruit is composed of from 2–5 leaf-like membranous valves growing on a common stalk. These valves are green or pinkish on the outside and yellowish within. They open much before the fruit is mature, revealing usually two yellow, much wrinkled seeds the size of a small bean, adhering one to each margin of the valve.

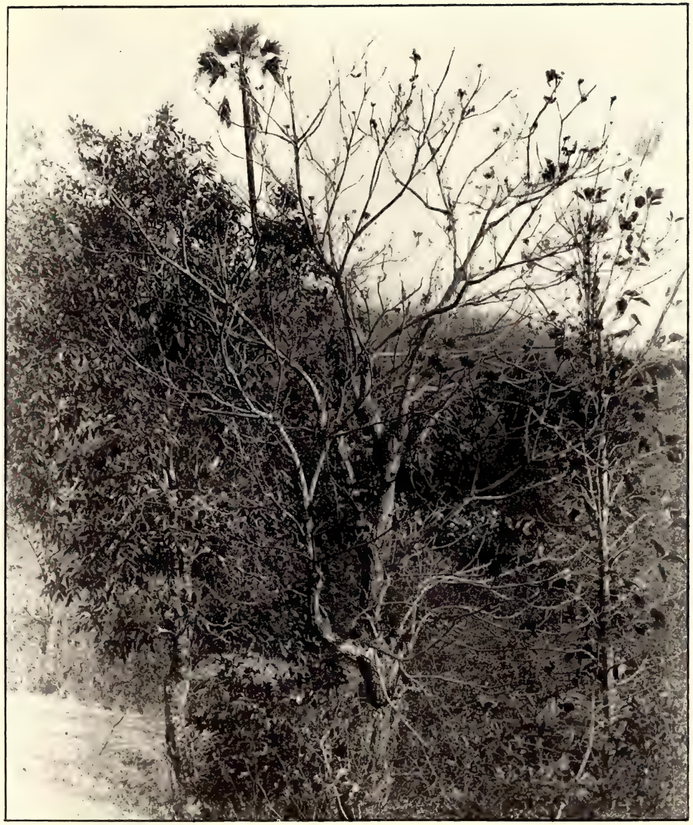




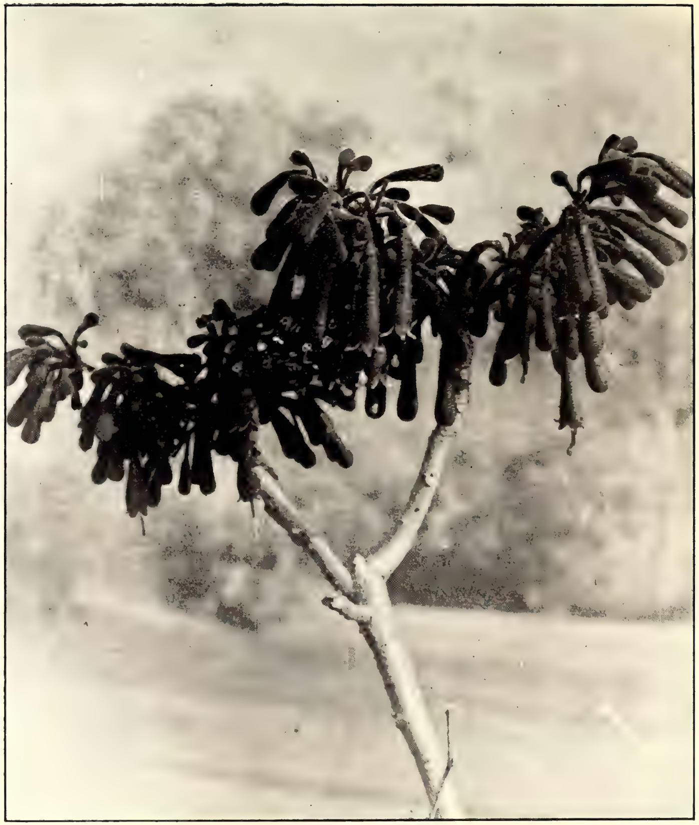
Flowering Season: March to May. Fruits, May to June. New Leaves, April to May.

Distribution: Satpuras up to 3,700 ft ; W. Ghats from South Kanara to Travancore, Konkan and Deccan Forest, N. Circars, Mt. Abu, East Bengal, Burma, Andamans, Ceylon. Indo-China, Siam.

Uses: The bark yields an inferior fibre. The twigs and leaves are used in the W. Peninsula as a cattle fodder. The flowers are used in some parts of the country such as the Berars to decorate the horns of cattle during the Holi Festival.

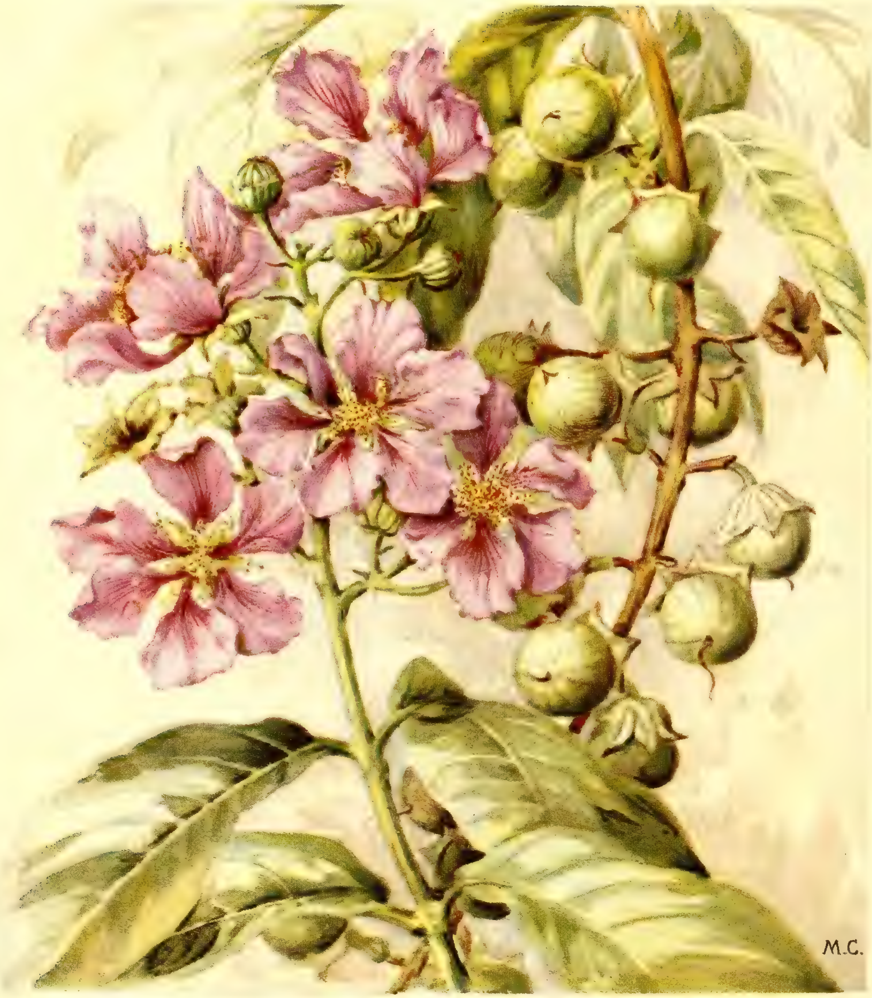


The Coloured Sterculia (*Sterculia colorata*), in flower.



Flowers of the Coloured Sterculia (*Sterculia colorata*).

Photos by C. McCann.



John Bale Sons & Danielsson, Ltd. London.

THE QUEEN'S FLOWER.
Lagerstroemia flos reginae, Retz.
(about ½ nat. size).

THE QUEEN'S FLOWER

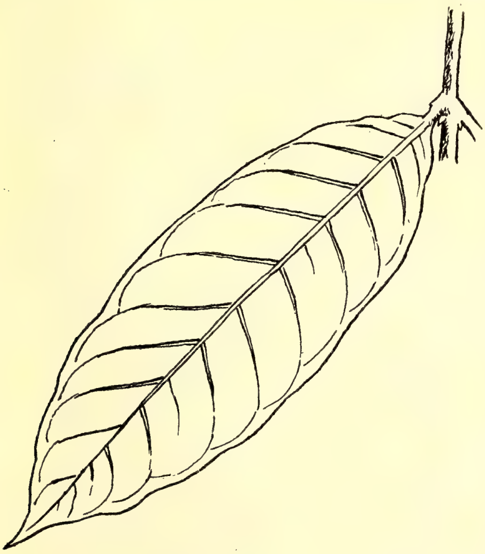
Popular Names: Arjuna, Jarul (Hind.); Jarul (Beng.); Gara Saikre (Kol.); Sekra (Santal); Ajhar, Jarul (Assam); Bolashari (Garo); Taman, Bondara (Bomb.); Bondara, Mota-bondara (Konkan); Taman, Tamana, Mota-bondara (Mar.); Kadali (Tam.); Chennangi (Tel.); Challa, Holedasal, Maruva (Kan.); Adamboe (Malay.); Konepyinma, Pyinma (Burm.); Kamaung (Magh.); Murute, Muruta-gass (Sing.); Arjuna (Sans.).

Lagerstrœmia Flos-Reginae Retz. Obs. (1789) fasc. 5, p. 25. Family (*Lythraceæ*).

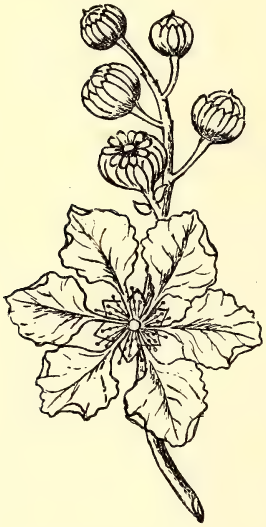
(After Magnus v. Lagerstroem, 1696–1750, a Swede and friend of Linnæus; *Flos-Reginæ* means flowers of the Queen.)

This tree does not grow to a large size in Bombay, about 20 feet in height only, probably because Bombay is too far North for it to excel in growth, but it is a beautiful sight when in flower from May to July. There are various shades of colour in the flowers of these trees, some being purple and others different shades of mauve, approaching to pink and these light pinkish mauve varieties are perhaps the most beautiful. The upstanding panicles of the flowers rather remind one of the shape of the white racemes of the horse-chestnut when in flower in England.

Description : A moderate sized tree but when growing on the banks of forest streams, it may reach a height of 60 ft. The trunk is straight. Its pale bark flakes off in irregular patches. The branches spread widely. The leaves grow on stout stalks; they are paler in colour below, oblong-lance-shaped and bluntly pointed at the tips. A leaf measures from 5″–8″ in length and 1½″-3″ in width. Its main nerves, there are from 10–13 upward curving pairs, are conspicuous and prominent. A network of fine veins covers both surfaces of the leaf.



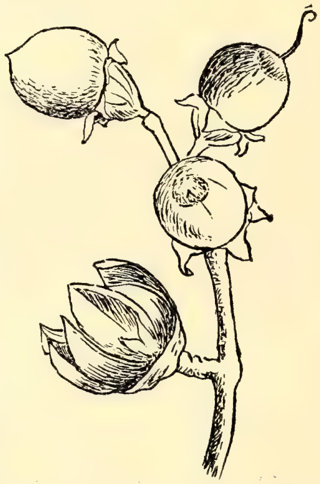
The tree sheds its leaves during the cold weather when some of the leaves turn coppery red or yellow. But this leaf-fall is generally gradual. Few trees are absolutely bare. The young leaves come out with the blossoms in May. Then the tree covered with great clusters of large mauve flowers is a delight to the eye. Its massed flowers have not the aggressive beauty of the Gold Mohur or the Flame of the Forest but their soft pastel colouring is tenderly attractive and pleasing. Each cluster or panicle of flowers may be quite a foot in length springing from the branch as an upstanding spike, massed with flowers at its base and bearing numerous downy pink and green buds towards its tip. The earlier flowers at the bottom of the spike fade to a paler tone thus varying the colours of the cluster from deep to palest mauve. The colouring of the flowers varies in different trees; in some it is almost purple, in others mauve or pinky-mauve, while there is a beautiful variety in which the colours are bright pink. The calyx of the flower is green. It is covered with a white, sometimes reddish down. It has from 6 to 7 sepals which are fused together and form a heavily-ribbed cup with a lobed brim.



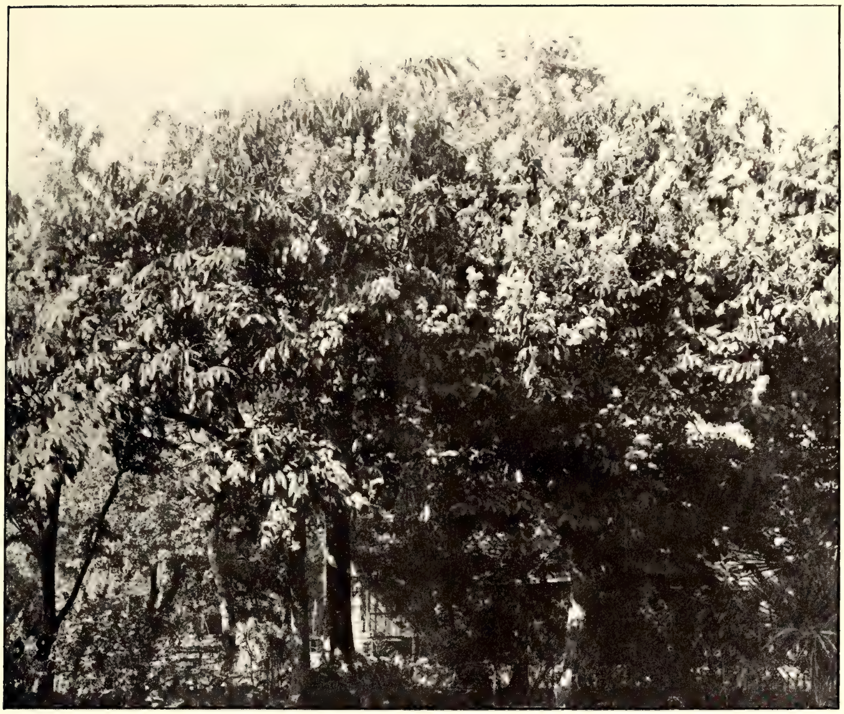
There are from 6 to 7 petals, very crinkled and wavy, rounded at the apex and clawed or narrowing suddenly at the base. The stamens are all equal, shorter than the style, they are purplish red and bear yellow anthers. The tree fruits in great profusion and the fruits persist for a long lime. Green fruits of the year are seen on the tree together with blackened fruits of the preceding season. They are globular in shape and contain smooth pale brown seeds.

Flowering Season: Flowers during the hot season and fruits during the rainy season. But young trees may be found in flower late in the rains.

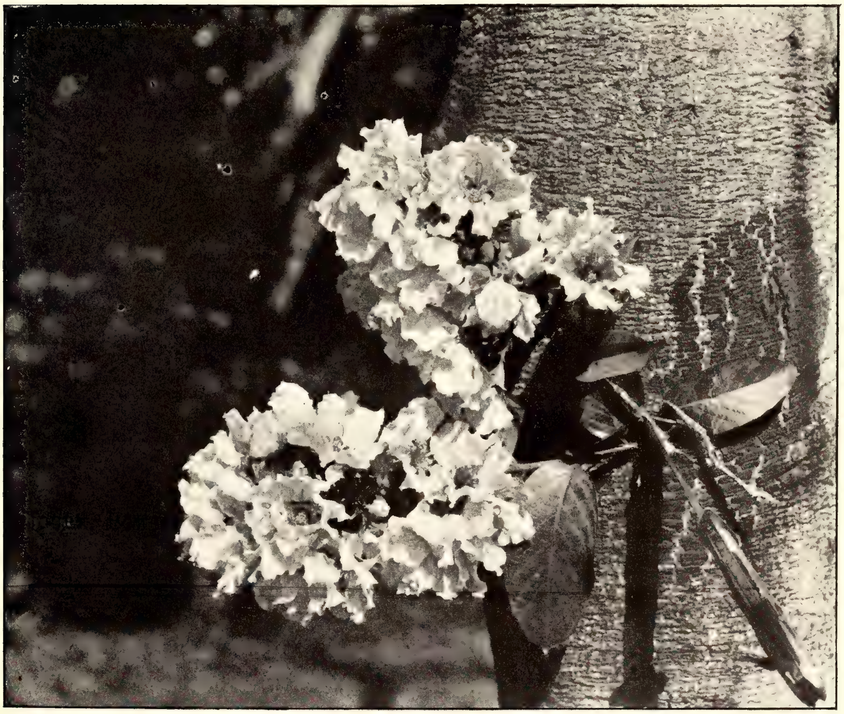
Distribution: W. Ghats of N. Kanara and S. Konkan through Malabar to Travancore, along the banks of nalas and rivers and in swampy localities, N. Circars, Chota Nagpur, E. Bengal, Assam, Burma, Malaya, China, Ceylon. Very often cultivated, especially so in the Gorakhpur district of the United Provinces.



Leaf-shedding Flowering and Fruiting: The tree sheds its leaves about February-March, the leaves turning reddish before falling ; the new leaves appear in April–May. The large terminal panicles of mauve flowers 2–3 inches in diameter, appear from April to June, at which time the trees are extremely handsome. The capsules 5--6-valved, broadly ovoid, 0·7–1 inch long, ripen from November to January, according to locality, though they do not actually open and scatter the seeds for some little time. The seeds are light brown, angular, fairly hard, with a stiff, brittle wing, the whole $\frac{3}{5}$–$\frac{7}{10}$ inch long ; they are often unfertile. The tree seeds at an early age ; vigorous plants raised from irrigated broadcast



The Queen's Flower Tree (*Lagerstroemia Flos Reginæ*), in flower in the Victoria Gardens, Bombay.



Flowers of the Queen's Flower Tree (*Lagerstroemia Flos Reginæ*).

Photos by C. McCann.

sowings at Dehra Dun commenced to bear seed at the age of three years.

Gardening : ' In full blossom in the morning the tree looks as if mantled with roses, but the flowers change through the day to a beautiful purple, making it appear at evening, if seen from a short distance, like a bower of English lilacs.'—(Hunter).

During the first season the growth of the seedling is slow, a height of only 2–6 inches being ordinarily attained by the end of the year; subsequently the growth is considerably faster. Weeding and irrigation, particularly the former, greatly stimulate growth. Owing to the lightness of the seed and the small size of the young seedlings, direct sowings are less suitable than transplanting from the nursery.

Uses : This is the most valuable timber of Sylhet, Cachar, and Chittagong, and in Burma the next in value after teak. It is used in ship-building, and for boats and canoes, all kinds of construction, timber and carts.

Medicinal Uses : The root is prescribed as an astringent. The root, bark, leaves and flowers are used medicinally by the Natives. It is stated that the seeds are narcotic, the bark and leaves purgative. The fruit is used in the Andamans as a local application for aphthæ of the mouth.

Another species of the same genus is widely grown in Indian gardens: The Crape Myrtle (*Lagerstrœmia indica* Linn.) called Chinai-Mendhi. It is a native of China. It is one of the most beautiful shrubs in our gardens, grows to a height of 7–8 ft. The flowers hang in branches at the extremity of the branches. The flowers are usually bright pink, but there are dark crimson, bluish, purplish and white forms. It flowers at the beginning of the rainy season. Easily propagated by cuttings or seeds.

(To be continued).

THE RHESUS MACAQUES (*MACACA MULATTA*).[1]

BY

R. I. Pocock, F.R.S.

Temporary Assistant in the Zoological Department of the British Museum.

(*With a plate and two text-figures.*)

Introduction.

There is no monkey better known in northern India than this species, the Bandar; and no monkey is more familiar as an exhibit in the Zoological Gardens of the world where it is invariably called the Rhesus. But it has never been adequately studied from the point of view of individual, seasonal and local variation.

As I understand the species, it has a far wider geographical distribution than any other Macaque, its range extending through the Himalayas, up to 5,000 ft. or 6,000 ft., from Kafiristan and Chitral to Assam and beyond to Burma and Siam and thence northwards into the Tsheli Province of China. South of the Ganges it occurs, as far to the west as Gujerat and according to Blanford, as far to the south as the Godaveri.

Collectors for the Mammal Survey of India secured a large number of specimens, many of which are in the British Museum, and the subject-matter of this paper is based upon an examination of that material, supplemented by specimens obtained from a variety of sources and stored in the Museum.

Range of Colour Variation in the Rhesus.

A marked specific character of this monkey is the yellowish or orange-red hue of the hind quarters where the hairs are grey or whitish in the basal half and yellow or orange in the outer half. On the fore quarters and head the hairs are typically annulated with orange or buff and blackish or grey. But sometimes a generally orange or yellowish hue pervades the whole of the upper side, although it is never so intense on the fore back, shoulders and head as on the rump and thighs. It may be crudely asserted that the species has an innate tendency to erythrism; and in monkeys addicted to that variation degrees in the brightness and extension of 'russet' are untrustworthy criteria for subspecific differences.

As an instance of individual variation in the species I will describe two adult males of almost exactly the same size and collected by H. W. Wells at Rajapara in South Kamrup, 600 ft. alt., one on

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[1] For the substitution of the name *Macaca mulatta* for *Macacus rhesus* and for the disentanglement of the involved synonymy of this species, see the paper by Hinton and Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xxvii, pp. 665-669, 1921.

November 21st, the other on November 25th, both being in perfect coat.

a. Head, nape and shoulders yellowish olive in general tint, the hairs clearly annulated with bright yellowish buff, ashy grey at the base; the back brighter and yellower turning to orange on the loins and almost fiery red on the outside of the thighs, the basal half of the hairs on the bright red areas being white and the distal half red and not annulated. Tail like the rump at its base, greyish olive terminally. Arms grey, with yellowish buff speckling giving an olive hue. Legs washed with bright yellow, paling from the thigh to the foot which is greyish yellow. Some black hairs on the brow and close to the face; cheeks speckled, a little lighter than the top of the head. Under side mostly white, slightly reddish on the belly.

b. Much darker. Head, nape and shoulders deep greyish olive in general tint, the hairs annulated with pallid greyish buff, deeper smoky grey at the base; the back yellower olive, the lumbar region being like the head and nape of the other specimen. Buttocks and outside of thighs not nearly so fiery, the red being less bright and smaller in extent. Tail much darker. Arms a little darker, with grey ticking, hands blacker. Legs, feet and underside very much as in the first specimen.

Here and there occur specimens which are rich rusty red all over the dorsal surface from the head to the rump, although brighter behind than in front. One of this type, an adult female, was secured by A. C. Miller on January 2 in the Dangs, Surat District, associated with another not quite so red and with a young one much duller in tint, yellowish olive in front and not so bright behind. Quite as red as the first is a specimen from Dharmsala 4,500 ft. in the Punjab, shot by H. W. Wells on February 2; and even redder than these is a specimen secured by the same collector at Boska Nadi, N. Kamrup, 2,000 ft., on January 5, 1920.

Another variable character in these monkeys is the length of the tail as attested by the table of measurements given below.

SEASONAL CHANGES IN THE COLOUR AND LENGTH OF THE COAT

In the paper I recently published on the Bonnet Macaque (*Macaca radiata*) of South India, I showed that the coat is at its best, so far as colour is concerned, in the winter months, that it gradually fades through the spring and has a shabby and dead look just before the moult, which occurs in June or July.

The same series of phenomena takes place in *M. mulatta.* In the winter from about November to January the coat is perfect in colour and texture as described in the case of the two examples from Rajapara in South Kamrup, shot at the end of November. It is then soft in texture, the long hairs overlapping each other so as to conceal the grey tint of their basal portions.

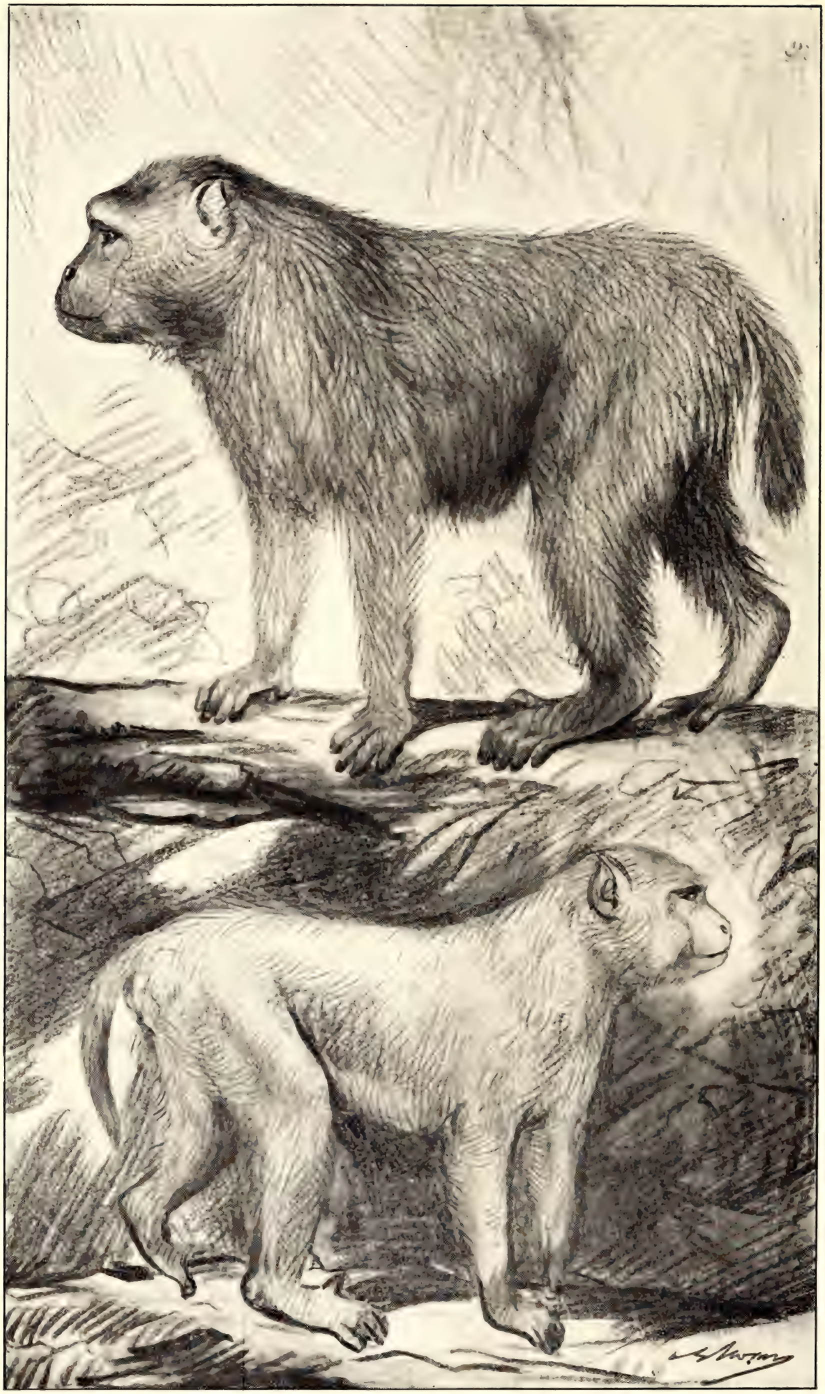
There is some evidence that the coat may go on increasing in length during the early months of the year and that fading may set in towards the end of February. For example, a female shot on January 9 by Baptista at Hasimara, 600 ft., in Bhotan Duars, which is almost exactly like a male he shot 2 miles W. of Gorkha, N.-W. Nepal, on December 7, is shorter in the coat and much more brilliantly coloured than a male shot at Bharnabhavi, 600 ft., Bhotan Duars, on February 21. These differences may, however, be independent of season, because the Bharnabhavi specimen very closely resembles the darker of the two specimens (*b*) shot in South Kamrup on November 25 and a male shot by J. M. D. Mackenzie 20 miles S.-W. of Kindat in Upper Burma on January 3rd.

Through March, April, May and June the coat gradually loses its lustre, softness and colour, the hairs tend to become uniformly tinted buffish or brownish grey and to adhere loosely in irregular bands or patches displaying the greyer hue of their basal portions. It then exhibits a shaggy, streaky appearance and is decidedly harsh to the touch. When remnants of the old coat are found in places after the new coat is up, the hairs are all uniformly greyish without a trace of buff in them. I am inclined to think that their distal, originally annulated ends break off from brittleness.

The moult is not exactly coincident in time even in the same locality, and no doubt varies still more with altitude or latitude in accordance with the earlier or later onset of warm weather. In two specimens, for instance, shot at Samyala, Kangra, 5,000 ft., by H. W. Wells on May 9, although the coat is long, shaggy, streaky and obviously faded in both, in one only has the moult set in as shown by a large median cap of new short hair on the forehead. This area appears to be always the first to clear. It is the only part that is cleared, for example, in a male with a faded shabby coat, shot at Kakara in Damoli, 1,200 ft., by Crump on May 12; and in another male shot by Shortridge on June 6 at the Mamsano Falls of the Nano Sao River, 2,000 ft., in the North Shan States.

From the evidence of other specimens it seems that the moulting of the forehead is followed by that of the extremities and the tail. A faded, shabby coated specimen, for instance, secured by Baptista on June 15 at Bouzini in Nepal has the forehead, feet and tail covered with quite short fresh hair. The tail, it may be added, in this and similar cases is exactly like that of the Pig-tailed Macaque, *M. nemestrina*.

In several cases in which the crown and feet are covered with short new hair while the rest of the body still carries the old, faded, shabby coat, the new hair of the dorsal surface can be detected beneath the old. This is clearly illustrated by a male example shot on June 15 at Patriata, Murree, 7,150 ft., by H. W. Wells. Here the long, shaggy hairs, sooty grey on the back of the head, the nape and shoulders and tipped with rusty brown on the loins, are everywhere underlain by the new short coat which is annulated reddish and black. A very similar condition of the coat is exhibited by two Burmese examples from Tatkon, 250 ft., near Kindat on the Upper Chindwin River, shot by G. C. Shortridge on July 5, and from Mingun in Upper Burma shot by the same collector on July 12. These three specimens suggest that the moult



UPPER FIG.—McMahon's Rhesus (*M. mulatta mcmahoni*) from Chitral.

LOWER FIG.—Common Rhesus (*M. mulatta mulatta*) from Bhotan Duars.

is later in Burma than in the Western Himalayas. However that may be, the moult is usually completed by August although in one specimen obtained by C. A. Crump on August 1 at Luia, Chaibassa, about 250 miles west of Calcutta, some of the old hair, lustreless and dull grey in hue, is still retained on the back. A still later date for its retention is attested by an example from Lamsakhang in the Cachar Hills shot on September 10.

One or two of the specimens from Upper Burma collected by Shortridge and Mackenzie in that country have already been referred to. In connection with these, I must add that a splendid series, ranging from Hkamti in the north to Prome and Toungoo in the south, was obtained by these collectors at various months of the year, mostly in the summer. These, with the exception of one probably wrongly-dated skin, bear out the conclusions regarding the moult and colour-change described above.

I have been quite unable to find any external character by which these Burmese specimens can be distinguished from specimens of typical *mulatta* from India.

THE LOCAL RACES OF THE RHESUS

Since several subspecies of *M. mulatta* are, in my opinion, admissible, it is necessary to fix upon one of them as the typical form to carry that name. The selection is narrowed by Pennant's statement that the living individual he described as the Tawny Monkey, which Zimmerman named *mulatta,* came from India; but it may have been captured near Bombay or Calcutta or in one of the hill-stations. For the specimen described by Buffon, the type of *rhesus, fulva* and *erythræa* which are synonyms of *mulatta,* no locality was given. But for the monkey represented by the synonym next in order of date, namely *oinops* Hodgson, 1843, a definite locality, the Nepal Tarai, is known; and since I concur with Anderson, Blanford, Hinton and Wroughton in considering *oinops* the same animal as *mulatta* (*rhesus*), I propose to regard the Nepal Tarai as the locality of the typical race.

THE COMMON INDIAN AND BURMESE RHESUS

Macaca mulatta mulatta, Zimm.

Macaca mulatta, Zimm., 1780; *fulva,* Kerr, 1792; *rhesus,* Aud., 1798; *erythræa,* Shaw, 1800; *oinops,* Hodgs., 1840; Hinton and Wroughton, *J. Bomb. Nat. Hist. Soc.,* xxvii, p. 665, 1921.

Pithecus brevicaudus, Elliot, *Rev. Prim.,* ii, p. 216, 1913.

Macaca siamica, Kloss, *J. Nat. Hist. Soc., Siam,* ii, p. 247, 1917.

To the synonymy of this race published by Hinton and Wroughton I have added, for reasons given below, the last two names on the list.

The range of variation in the colour of this race is practically covered by the descriptions given above of the two examples from Rajapara in South Kamrup.

The following notes on some specimens referred to this race may be interesting.

Nagarcot, Nepal, 8,000 ft. (R. L. Kennion). October 15th. An adult female, colour very much as in Rajapara *a*. The coat is soft and short, barely 2 inches on the shoulders despite the altitude which is considerably above that of any other specimen in the collection. It is shorter than in October skins of *villosa* from Kumaon at much lower elevations. The head and body are 1 ft. 9 ins., the tail 9 ins.

Chengli, Ghorkha, W. Nepal (N. A. Baptista). December 7. A male skin, redder than the last, with a softer fuller coat, the hair on the shoulder about 2½ ins.

Hazaria Pathergatta, the Nepal Tarai, 600 ft (N. A. Baptista). February 17. A topotype of *mulatta* as indicated by *oinops*. The colour almost identical with that of Rajapara *a*. The winter coat is neither wavy, woolly nor particularly thick, the hair on the shoulders being a little over 2 ins.

Bouzini, the Nepal Tarai, June (N. A. Baptista). The moult is just setting in and the old discoloured woolly winter coat measures about 2 ins. on the shoulder.

Bharnabai, 600 ft., and Hasimara, 600 ft., in the Bhotan Duars (N. A. Baptista). Several specimens varying considerably in colour and intergrading completely in tint between *a* and *b* of the Rajapara pair. In a male from Hasimara, January 1, the coat is only about 2 ins. on the shoulder; in one from Bharnabai, February 21, it is nearly 2½ ins. Two ♀ from Hasimara, January 8, are softer coated than the ♂. The Bhotan Duars are similar in physical features to the Nepal Tarai.

Bogra Nadi, 2,000 ft., N. Kamrup (H. W. Wells), Jan. 5. A young well-coloured ♂ with soft thickish fur but the hair only about 1½ in. long.

From comparatively low-lying country south of the Ganges the Survey unfortunately secured only a few specimens which seem referable to this race.

Luia, Chaibassa, 1,000 ft. (C. A. Crump), Sept. 1. Two young specimens above referred to as just free of the old coat, the new coat being very short and sleek.

Sohagpur, Hoshangabad, 1,000 ft. (C. A. Crump), April 10, ♂ adult. The winter coat still retained but shabby, streaky and faded, dull grey, with pallid buff tips to most of the hairs on the fore part and washed out orange on the rump. The cheeks, feet and tail below are white and the hands nearly so. The hair on the shoulders is from 2 ins. to 2½ ins. in length.

Kokara, Damoh, 1,200 ft. (C. A. Crump), May 12, ♀. Colour and coat much as in the last but new coat appearing on the forehead; the colour rather darker, the cheeks, hands and feet and lower side of tail not white.

Dangs, Surat, (C. A. Miller), Jan. Three flat ♀ skins. The coat is soft and thickish and about 2 ins. long. The colour, as pointed out above, is individually very variable.

In Assam H. W. Wells procured specimens from the following localities:—Nangpon, Khasia Hills, 1,200 ft.; Lamsakhang, Cachar, 200 ft.; Golaghat, Dening in the Mishmi Hills, 2,250 ft. These specimens show no distinctive characters; and the same is true of examples collected by Messrs. G. C. Shortridge, S. A. MacMillan and J. M. D. Mackenzie at the following localities in Burma:—Hkamti, Homalin, Tamanthe 460 ft., Kindat 600 ft., Tatkon 200 ft. in Upper Chindwin; at Yin, Alicha in the Chin Hills 1,000 ft. in Lower Chindwin; Pyaungyaung 2,790 ft., Mamsano Falls, Nano Yao River, 2,000 ft., Seen Hsipaw State 410 ft in the Northern Shan States; and farther south at Mt. Popa, to the east of Toungoo, 100-500 feet; and 30 miles S.-E. of Prome, 800 ft.

The most southern localities for typical *mulatta* in Burma on this list are Toungoo and Prome. How much farther south the animal extends is unknown; but it is not found in Tenasserim.

To the east of the Shan States in Northern Siam this race also occurs. At all events C. B. Kloss gave the name *Macaca siamica* to an adult male example collected at the Me Ping rapids, below Chiengami, 850 ft., (*Journ. Nat. Hist. Soc. Siam,* II, p. 247, 1917), and I cannot find either in the description of the skin or the measurements of the skull a particle of evidence to justify the admission of *siamica* as a symbol even of a local race of *M. mulatta.* But Kloss's acquaintance with the macaques of this group was practically restricted to Elliot's *Review* which has only a bibliographical value. Kloss drew attention to certain particulars in which the Siamese skull differs from the figures of the skull of the Hainan rhesus published by Elliot. But the two skulls are very different in age, the one from Hainan being much younger with the sutures of the upper side very clearly defined, whereas in the Siamese skull all the sutures, according to Kloss, are obliterated.

I have seen no examples actually from Siam; but farther eastward, in Annam and Tonkin, Delacour and Lowe, met with this monkey and sent three females to the British Museum.

The Tonkin specimens were taken at Bac Kan, 500 ft., on December 13 and 24. They are therefore in perfect colour. One of them is practically indistinguishable from some examples of *mulatta* from Hazaria Pathergatta in the Nepal Tarai and from Hasimara in the Bhutan Duars described above; but the base of the hair is more sea-gull grey, and the tail is fuller.

The second specimen is distinctly darker, the hairs being more sooty-grey basally, with the pale annuli on the fore part and the rump more rusty. The tail is not so bushy.

The Annam specimen taken at Phua-a-Qui, 100 ft., on February 28th is not nearly so bright as the foregoing, the fore quarters being more olive and the rump is less red. It is not so red behind as a ♀ from the Bhutan Duars but is almost identical in colour with it on the fore parts.

I am unable to distinguish these skins from Indian specimens referred to *M. mulatta mulatta.*

The same must be said of examples from Hainan. Swinhoe was the first apparently to record the existence of a Rhesus-like monkey in Hainan (*Proc. Zool. Soc.,* 1870, p. 226). He quite correctly identified it as *Macacus erythrœus,* one of the many names given to the Rhesus; and one of his specimens, a young male, killed in March 1868, was presented to the British Museum.

Subsequently several specimens were acquired from Mt. Washi on the island by the American Museum of Nat. Hist., New York. Elliot got hold of these and described them as representing a new species under the name *brachyurus* (*Ann. Mag. Nat. Hist.* (8), iv, p. 251, 1909) which, on account of its preoccupation[1], he altered afterwards to *brevicaudus* (*Rev. Primates,* ii, p. 216, pl. xxiii, 1913.). He wrote with assurance about the distinctness of this monkey from the Indian *rhesus,* claiming its tail to be much shorter and its colouring much brighter. He also laid particular stress on some cranial features; but since there seems to be no doubt that he compared his skulls from Hainan with abnormal skulls of *mulatta* reared in captivity, of which there are many in the British Museum, where he was working at the time, the skull characters he mentioned have no value.

The measurements[2] he quoted for the skin, give the head and body as 510 mm. (=20 2/5 ins.) and the tail as 220 mm. (=8 4/5 ins.), the tail being considerably longer than the foot and between one-third and one-half the length of the head and body. There is nothing unusual about the dimensions. The actual measurements, indeed, of the type of *brevicaudus* coincide very closely with those of a male, collected at Damoh in the C. P. of India, in which the head and body are 515 mm. and the tail 218 mm., the tail being a trifle shorter in proportion than in *brevicaudus.* But, as has been shown, the length of the tail is very variable in these monkeys. And Elliot's statement that the colour of the Hainan rhesus is much brighter than in the typical Indian form, is entirely unsupported by the facts known to me. At all events, the two specimens of it that I have seen are duller in tint than most of the Indian specimens, the topotype being almost as close a match as it is possible to imagine with the two examples from Chaibassa, to the west of Calcutta, which must be assigned to typical *mulatta.*

The two Hainan specimens in the British Museum show certain differences in colour, no doubt mostly, if not wholly, seasonal. In the topotype of *brevicaudus* collected on October 10, when the coat was almost fresh, it is tidy, comparatively short and the hairs of the head, neck and fore-part of the body are annulated with yellowish buff and blackish grey, the general effect being olive at a distance; and the hind quarters have but little brightness about them. Swinhoe's specimen, shot in March, has, on the contrary, the coat distinctly longer and rougher, the hairs on the fore quarters being curled and dead at the tips and exhibiting very inconspicuous annulation. The arms also are browner and the under side a less dusky grey. The made-up skin measures: head and body 15 inches, tail 7·1 inches, and the hind foot 4·5 inches, the proportions being about the same as in Indian specimens.

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[1] By Hamilton Smith (*Jardine's Nat. Libr.,* i, p. 103, pl. i. 1842), who gave the name to an albino macaque with a very short tail. Elliot put *brachyurus* amongst the synonyms of *nemestrinus;* but obviously quite without justification, the tail of *brachyurus* being much too short for *nemestrinus.*

[2] Presumably these dimensions were taken in the flesh by the collector. But a topotype received from the American Museum and presumably one of the specimens Elliot examined, has no measurements, nor is there any provision on the collector's label for them.

The following table gives the principal dimensions, taken in the flesh in English inches of specimens ranging from Central India to Tonkin.

Locality & Sex		Head & Body	Tail	Hind Foot	Weight
Hazaria Pathergatta, Nepal Tarai.	♂	21 6	10·4	6·4	
Ghorkha, Nepal,	♂	20·8	10	6·4	
Rajapara, S. Kamrup,	♂	21 6	9	5 6	16½ lbs.
Hasimara, Bhotan Duars,	♂	19	8·8	6	
Damoh, C. India,	♂	20·6	8·8	6·2	
Mingun, Upper Burma,	♂	22	8	6·4	15 lbs.
Homalin, Chindwin,	♂	23	8·4	5·8	
Mamsam Falls, N. Shan States,	♂	21·4	8·2	6·3	15½ lbs.
Siam (*siamica*).	♂	19·8	9·4	5·4	
Chaibassa, Bengal. Young	♂	14·4	9	5·3	
,, ,, Young	♀	16	7 2	5·6	
Nagarcot, Nepal,	♀	21	9	6·3	
Narbong, Darjiling,	♀	20·2	8·4	5·6	11½
Hasimara, Bhotan Duars,	♀	17·6	9	6	
Sohagpur, C. India,	♀	18·6	8·5	5·8	
Mishmi Hills,	♀	19·2	11·2	5·8	
,, ,,	♀	16·4	9·6	5·7	
Kindat, Upper Burma,	♀	17·2	9·6	5·7	11
Pyaungyaung, N. Shan States,	♀	20	7·4	5·4	13
Tonkin,	♀	20·8	8·4	5·8	
,,	♀	19	8	5·6	
Annam,	♀	18	7·6	5·8	

This table shows tolerably close agreement in size between specimens assigned to this race; but it somewhat surprisingly reveals very little difference, except in weight, between the males and the females.

The tail, it will be noticed, although always longer than the hind foot, is very variable, occasionally over one half the length of the head and body, but usually between one half and one third. I have inserted the dimensions of two young specimens from Chaibassa to illustrate its individual variation in examples from the same locality.

The following are the principal cranial dimensions[1] of a few specimens assigned to *M. mulatta mulatta.*

Locality and Sex		Skull in inches.					Teeth in Millim.		Remarks
		Total Length	Zygom. Width	Orbital Width	Width of Maxilla	Length of Mandible	Upper Cheek Teeth	1st Upper Molar	
Nepal,	♂ ...	4·4	2·9	2·5	1·6	3·1	31	8 × 8	
,,	♂ ...	4·5	...	2·6	1·6	3·3	31	8 × 8	One of Hodgson's examples of *oinops*.
,,	♂ ...	4·7	...	2·7	1·6+	3·4+	34	8 × 8	
Bhutan Duars,	♂ ...	4·8	3·3	2·5	1·6	3·4	35	9 × 8	
,,	♂ ...	4·5	3·3	2·5	1·5	3·2	33	8 × 8	
Chittagong,	♂ ...	4·8	3·2	2·6	1·5+	3·4	32	8 × 7	
Kindat, Upper Burma,	♂ ...	4·7	3·3	2·7	1·6	3·5	33	8 × 7	
'Siam',	♂ ...	4·8−	3·2	2·6	...	3·5	31+	...	Type of *siamica*, Kloss.
Nepal,	♀ ...	4·2	3	2·4	1·4+	...	34	8 × 8	B. H. Hodgson. Labelled *oinops*. Old ♀.
Darjiling,	♀ ...	4·2	3	2·5	1·4	3	30	8 × 8	
Bengal,	♀ ...	4·3	3·1	2·6	1·6	3·1	32	8 × 8	Prof. Oldham. Old ♀.
Dangs, Surat,	♀ ...	4·1	2·7	2·3	1·5	3	27	8− × 8−	
Mishmi Hills,	♀ ...	4·3	...	2·5	1·5	3·2	30	8 × 8	
H'Kamti, Chindwin,	♀ ...	4·1	2·8	2·3	1·3	2·8	28	7 × 7	
BacKan, Tonquin,	♀ ...	4·5	3·2	2·6	1·6	3·3	29	7 × 7	
,,	♀ ...	4·3	3·1	2·7	1·6	...	33	8 × 8	
Phu Qui, Annam,	♀ ...	4·3	2·9	2·4	1·5	2·9+	30	7 × 7	

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[1] Here and elsewhere in this paper the width of the maxilla is taken just above the 1st molar, the penultimate cheek tooth. The cheek teeth are those behind the canine.

Although the male skulls in this list agree tolerably closely in dimensions, no two are precisely alike, the individual variation in the roundness of the crown, the prominence of the occiput and of the jaws, the length from the brow to the nares and the degree of concavity of the interorbital and nasal bones, being very considerable. It may be noted that Kloss's type of *siamica* is in close agreement with examples from Bhutan Duars and Chittagong.

The female skulls are almost equally variable, a good illustration being supplied by the three from Tonkin and Annam collected by Delacour and Lowe. The first of these is a little larger than any of the Burmese or Indian specimens. This is partly due to the prominence of the occiput. The second, an older animal, from the same locality, has the occiput much less produced, the maxilla much less pinched, the brows less prominent, the nasals much narrower and the teeth much larger. The Annam skull has such prominent brows that the interorbital septum is nearly vertical. In this as in other respects, except the smaller teeth, it closely resembles the Bengal skull (Prof. Oldham). They might, indeed, be sister-skulls.

THE RHESUS OF KASHMIR AND KUMAON

Macaca mulatta villosa, True.

Macacus rhesus villosus, True, *Proc. U.S. Nat. Mus.,* xvii, p. 2, 1894.

Pithecus villosus, Elliot, *Rev. Prim.* ii, p. 200, 1913.

Locality of type: Lolab at the northern end of Wular Lake, about 40 miles N.-W. of Srinagar in Kashmir.

Distribution: Southern Kashmir, Upper Punjab, Kumaon.

The original specimens of this monkey, collected by Dr. Abbott, were shot on September 8th and 9th, from four to six weeks after the completion of the moult when the coat should be comparatively short. But True described it as 'long, dense, and moderately wavy', and Elliot as 'long, loose and woolly'. Otherwise there is nothing in the description of this monkey, apart from a slightly larger skull, to distinguish it from the typical Rhesus.

Through the kind offices of Mr. Gerrit Miller junr., I have received on loan from the Smithsonian Institution, two of the specimens, an adult and a young male, described by True and Elliot. The coat in general is most emphatically neither long, loose, wavy nor woolly, but is short, close and smooth as in the normal new pelage of the Rhesus, although it is a little longer on the limbs, especially on the toes, in both examples and on the head in the smaller. The colour is a little redder and brighter than in average typical *mulatta,* the tail darker above and the hands and feet duskier; but the differences in the skins amount to very little.

Before examining these specimens, I had identified as *M. mulatta villosa* a fine series of Rhesus skins in the British Museum mostly obtained by the Mammal Survey, from tolerably high altitudes in the Himalayas, Kangra, Kumaon etc.

Of this series, one already historical, may be disposed of first. It is a female received from the Zoological Society in 1871 and labelled Kashmir. But according to Anderson it was purchased at Delhi or Agra from a native who stated it came from Kashmir, which is, of course, no proof that it did. (*Zool. Res. Yunnan,* p. 73, 1878). Elliot subsequently got hold of this specimen and thinking it belonged to the Macaque from Fokien in Eastern China which he described as *Pithecus littoralis,* stated that the animal was 'evidently erroneously attributed to Cashmere'. (*Rev. Prim.* ii, p. 202[1]). I have no doubt that the monkey came from Kashmir. In tint the skin generally resembles that of typical *mulatta* and is well coloured; but the coat, although not exceptionally long is remarkably thick, woolly and close. On the toes the hair overlaps the long claws by ½ an inch. In the made-up skin the head and body are about 18½ ins., the tail, without the hair, about 9½ ins., and the hind foot, although shrunken, about 5 ins. Since the skull is very young, without trace of true molars, the dimensions of the skin indicate a large monkey.

The Survey secured examples at the following localities:—

Patriata, Murree, 7,150 ft., (H. W. Wells). An adult male shot on June 15th. This specimen has already been alluded to in connection with the moult. The old, long, shabby, discoloured winter coat is everywhere being replaced by new characteristically annulated hair.

Dharmsala, Punjab, 4,500 ft., (H. W. Wells). A young male shot on February 5. Very like the female from Kashmir and nearly as bright as Abbott's examples. A well-coloured skin, with considerable amount of red, in perfect coat, the hair long, between 2½ and 3 ins. on the shoulders, loose and beautifully soft, dark grey basally, red at tips. No measurements taken.

Samyala, Kangra, Punjab, 5,000 ft., (H. W. Wells). Two males shot on May 9th. A couple of shaggy skins with the moult imminent. In one the coat is shorter but considerably more curly than in the other. There is hardly a trace of red on the fore quarters, the general hue being dark greyish brown, but the red of the thighs and loins is retained although faded. In the dusky hue of the hands and feet and of the upper side of the tail, the larger of the two closely resembles True's *villosa.*

Kangra Fort, 2,450 ft., (H. W. Wells). An adult male shot on March 18. Coat loose but very long, about 3½ ins. on shoulders where the hairs are palish grey basally and with the tips already beginning to fade and curl; otherwise the colour is fairly normal although not nearly so dark and rich as in the example from Dharmsala.

Bageswar in Kumaon, 3,200 ft., (C. A. Crump). Two males and a female shot on October 1st and 3rd. These skins are decidedly longer in the coat than Dr. Abbott's specimens, but not so brightly coloured, the annulations being less distinct on the fore quarters and the red not so bright behind. Possibly the difference is due to the later season. The female is duller, more olive in tint.

Ratighat, Naini Tal, Kumaon, 3,700-3,800 ft., (C. A. Crump). A pair collected on November 1 and 5. The colour is as in the female from Bageswar and not so bright as in the males; and in the male the hair is much paler at the base, white on the hind quarters. The coat is long, 2½ ins. on the shoulder but not so thick.

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[1] An error Elliot fell into as a result of this mistaken identification is explained (*vide p.* 546 *infra*) in connection with the Chinese race.

Sitabani, Ramnagar, Kumaon, 2,000 ft., (C. A. Crump). Two males shot on November 22. Both are very well coloured, one of them being hardly distinguishable from Abbott's Lolab specimens but the coat is not so full and is greyer at the base of the hairs.

Dela Ramnagar, Kumaon, 1,500 ft., (C. A. Crump). A male shot on January 7. The coat is loose and long, 3 ins. or more in length and well coloured and annulated, but paler than in the Lolab specimens and with much less under fur, the base of the hair being paler ashy grey. It is not nearly so brightly coloured as in the Sitabani examples. As in them the measurements indicate that it is immature.

The following are the flesh measurements and weights of a few specimens:—

Locality and Sex	Head and Body	Tail	Hind Foot	Weight
Satriata, Murree, ♂ ...	25	12	7	...
Pamyala, Kangra, ♂ ...	23	10	6·7	...
,, ,, ♂ ...	20·5	10·5	6·5	...
Kangra Fort, ♂ ...	20	12·5	6	...
Bageswar, Kumaon, ♂ ...	22	11·5	6·8	22 lbs.
,, ,, ♂ ...	21·8	9·5	6·8	23 ,,
Ratighat, Naini Tal, ♂ ...	20·5	9	6·5	17½ ,,
Bageswar, Kumaon, ♀ ...	18·5	8·6	5·8	14½ ,,
Ratighat, Naini Tal, ♀ ...	19	10	5·6	13 ,,

These particulars indicate a heavier and on the average a slightly larger monkey than typical *mulatta;* but the differences are not very marked and there is no doubt that *villosa* intergrades with *mulatta* at the lower levels. The individual variation in the length of the tail as compared with the head and body and the foot is very considerable, as in typical *mulatta.*

The largest skull of this race in the British Museum is that of the male example from Murree. It is a little smaller than the skull of the type from Lolab; but the more open sutures indicate a younger animal with the skull probably not quite full sized. This is also indicated by the lighter mandible with lower ascending ramus. It also has the muzzle narrower and the brow-ridge in profile higher; but otherwise the skulls are unmistakably alike. The same applies to the skulls from Kangra and Kumaon, although no two are exactly alike in all characters. Except that these skulls are larger than those assigned to typical *mulatta* and on the average have deeper muzzles, more pronounced brows, and the temporal ridges in the adult closer together, although never actually joined, they are naturally very like those of the typical race.

It is interesting to note that the skull of a male Rhesus, ticketed Chunar, Benares, in the Museum Collection is *villosa*-like in form but is smaller and has an exceptionally short tooth-row.

In the following table of cranial measurements of examples of *villosa*, all actually approximately full-sized, are included those of the type of the Chitral race described below.

The skulls of *villosa* are decidedly a little larger on the average than those assigned to *mulatta*.

Locality and Sex	Skull in inches.					Teeth in Millim.		Remarks
	Total Length	Zygom. Width	Width across Orbits	Width of Maxilla	Length of Mandible	Upper Cheek Teeth	1st Upper Molar	
Chitral, ♂ ...	5·7	3·8 +	3·2	1·9	4·1 +	36	9 × 9	*M. m. mcmahoni* Type.
Lolab, ♂ ...	5·4	3·8	3·1	1·7	3·9	35	9 × 9	,, ,, *villosa* Type.
Murree, ♂ ...	5·2	3·7	2·9 +	1·6	3·8	35	9 × 9	,, ,, ,,
Kangra, ♂ ...	5·2	3·6	2·8	1·7 +	3·7 +	34	9 × 9	,, ,, ,,
Bageswar, Kumaon, ♂ ...	5·1	3·6	2·8 +	1·5	3·7	35	9 × 8	,, ,, ,,
Ratighat, Kumaon, ♂ ...	5·0	3·6	2·8	1·6	3·6	33	9 – × 8	,, ,, ,,
Benares, ♂ ...	5·0	3·6	2·8	1·6	3·6	30	8 × 8	,, ,, ,,
Ratighat, Kumaon, ♀ ...	4·4	3	2·5	1·5	3 +	31	7 × 8	,, ,, ,,
Bageswar, Kumaon, ♀ ...	4·4	3·2	2·5 +	1·5 +	3	30	8 × 8	,, ,, ,,
,, ,, ♀ ...	4·2	2·9	2·4	1·4	3	30	7 + × 7 +	,, ,, ,,

The Rhesus Monkey of Kafiristan and Chitral.

The earliest reference apparently to this monkey was made by Captain H. G. Raverty when he wrote:—'In some of the warmer parts of Kafiristan, in the densely wooded districts, monkeys of the largest size are found, but are not very numerous'. (*Journ. As. Soc., Bengal,* 28, p. 332, 1859). Blanford, who assumed this record referred to the Himalayan Langur, doubted the truth of it when he declared it 'requires confirmation' (*Mamm. Brit. India,* 1888, p. 30). But since Captain Raverty was writing of his own knowledge, Blanford's scepticism was perhaps a little uncalled for.

At all events, the correctness of Raverty's statement was established later by Sir Henry McMahon, G.C.V.O., G.C.M.G., K.C.I.E., who reported:—'Monkeys are to be found in the lower end of the Chitral Valley. Captain Gurdon saw a herd of them at Mirkandi on the bank of the Chitral river only 4,000 ft. above sea-level. The general characteristics seem to be those of *Macacus rhesus,* but all the specimens I have seen have, instead of a tapering tail, a tail of about 8 ins. coming to an abrupt end as if cut off like a fox terrier's'. (*Journ. As. Soc., Bengal,* 70, pp. 4-5, 1901). Subsequently in 1906 he procured an adult female for the Zoological Gardens and told me he was convinced of its distinctness from the ordinary Rhesus of India. It was certainly darker and thicker-coated; but close inspection of the living animal was impossible, and even after its death in 1910 I could not satisfy myself that it differed from the Kashmir race, *M. mulatta villosa,* which was known to me only from the very misleading description published by True in 1894. In reply to my inquiry, made in March this year, regarding the exact locality of this individual and the occurrence of the Rhesus in Kafiristan, Sir Henry McMahon wrote to me:—'The place where I saw a herd of these monkeys in a wild state and from where the Zoological Society's specimen came is in that part of Kafiristan which juts into the south-west portion of the Chitral State.'

Captain H. Fulton also observed this Rhesus in Chitral and, dissenting from McMahon's view of its distinctness, cited it as *Macacus rhesus* and recorded it as 'Very plentiful at the lower end of the Chitral Valley in summer on the right bank of the river. They come up as far as the Utzun Valley in troops at 5,000 ft. and probably come over the pass into Utzun from Kafiristan Valley.' (*Journ. Bomb. Nat. Hist. Soc.,* 14, p. 758, 1909).

When revising the 'Survey' specimens of the Rhesus in the British Museum, I came across the skin and skull of an adult male shot by Captain F. D. Stirling early in February at Kootai in Lower Chitral between the Bashgal Valley in Kafiristan and the Chitral Valley, 3,600 ft. alt. This specimen, represented by the skin and skull, had been identified by Wroughton as *villosa.* But since it differs from *villosa,* its nearest ally, in certain characters, I propose to describe it as a new subspecies dedicated to Sir Henry McMahon who from the first was convinced of the distinctness of the Chitral Rhesus.

Macaca mulatta mcmahoni subsp. nov.

Locality of type: Kootai in Lower Chitral, between the Bashgal Valley in Kafiristan and the Chitral Valley; 3,600 ft.

Distribution: Kafiristan and Chitral.

Description of Type: Coat extremely long, thick, shaggy, loose and wavy but silky in texture. Colour of head, shoulders and fore-back deep greyish olive, the hairs dark grey with tips very indistinctly annulated with buff, sufficient only to give a yellowish green wash over the grey; the hind-back brown, the annulations being a little brighter and more extensive, so that the grey of the hair, which is here lighter, is less in evidence. On the rump, which is redder, the hairs are more silvery grey with the outer half rusty yellow. This tint is continued on to the upper part of the thighs and the basal third of the tail; but the rest of the outer side of the leg is grey with a yellowish wash, the feet being a little browner; and the thickly haired tail gradually turns to a dark brownish grey towards the end. The arms, which are long haired to the elbow, and the hands are a deep almost blackish grey, with minute annulations only just perceptible. The crown of the head is blackish olive, with no perceptible speckling; the long hairs of the cheeks are grey with dark and paler annulations, and the whole of the under side, the inner side of the limbs and even the lower side of the tail are uniformly pale greyish white.

No measurements in the flesh were taken; but the dimensions of the dried skin are: head and body 1 ft. 11 ins., tail 9½ ins., hind foot 6 1/5 ins.

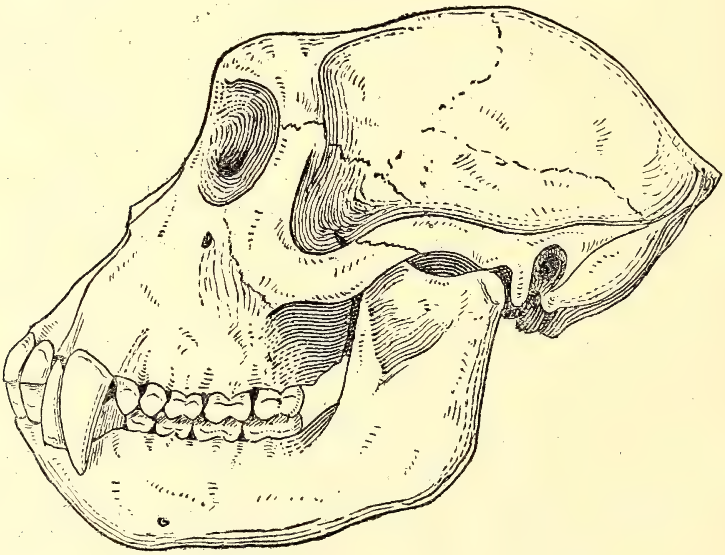

FIG. 1. (*a*) Skull of *M. mulatta mcmahoni* from Chitral.

Shot at the beginning of February, this specimen has the winter coat in full development and in no respects deteriorated. In the looseness and length of the coat of which the hairs on the shoulders measure up to 4 ins. (100 mm.) in length, and in the general darkness of its hue, the skin differs strikingly from those of typical *mulatta* and of *lasiotus* killed in the same month of the year. The colour, however, is not very different from that of the example of *villosa* from Murree shot on June 15 which still carries most of its winter coat; but the hairs are shorter and discoloured and the newly erupting coat shows that in mid-winter the monkey would have been conspicuously annulated with reddish buff all over the hind quarters.

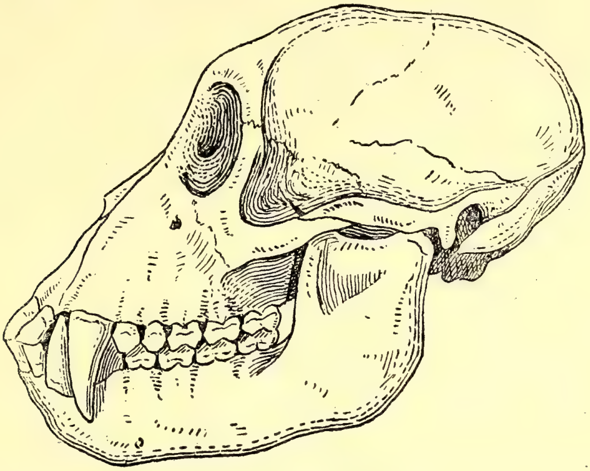

FIG. 1. (*b*) Skull of *M. mulatta mulatta*, male of about the same age from Bhotan Duars.

In the female specimen brought from Chitral by Sir Henry McMahon, which died on January 19th, 1910, the coat is not so long, streaky or shaggy as in the male described above but is thick, comparatively smooth, full and longish everywhere, about 2½ ins. (over 60 mm.) on the shoulders. The head and fore quarters are dusky olive and a little greener, less grey and rather more distinctly speckled than in the male; the head is not so dark on the crown but the cheeks are dark grey and unspeckled, darker close to the face; the arms are paler grey and unspeckled. The redness of the hind quarters is very much the same but is a little brighter and there is rather more colour on the outside of the legs and the top of the feet where the hairs are long and overlap the nails. The colour of the under side differs in the pallid rusty hue of the abdominal hairs. The measurements of the made-up skin are: head and body 1 ft. 9½ ins., tail 8½ ins., hind foot (stretched) 5¾ ins.

This skin is decidedly less brightly coloured and duskier olive on the fore quarters than average examples of *M. m. villosa;* but some of the duller specimens of the latter approach it in those respects.

The skull of the male specimen of *mcmahoni*, although youngish and probably not quite full-sized, is decidedly bigger than the average skulls of *villosa* and in addition has the brows much better developed. It is the largest skull of the Rhesus group that I have seen; but not so large as the reputed Rhesus-skull of which Elliot gave the measurements. This has the mandible 13 mm. (about ½ an inch) longer than in the Chitral skull. But Elliot supplied no particulars about his specimen and his identification of it carries no weight. Likely enough he had a skull of *m. assamensis* or *m. speciosa* in his hands.

The measurements of the type-skull of *mcmahoni* are published in the table with those of *villosa*.

THE RHESUS OF HONG-KONG AND FOKIEN.

Macaca mulatta sancti-johannis, Swinhoe.

Innuus sancti-johannis, Swinhoe, *Proc. Zool. Soc.* 1866, p. 555.

Pithecus littoralis, Elliot, *Ann. Mag. Nat. Hist.* (8), iv, p. 250, 1909; *id. Rev. Prim.*, ii. p. 201, 1913.

Locality of type of *sancti-johannis*: North Lena Island, Hong-Kong.

Locality of type of *littoralis*: Kuatun, N.-W. Fokien.

Closely resembling typical *mulatta* in colour but distinguishable from all the races hitherto considered by the shortness of the tail which is only a little longer than the hind foot. The skull, in the ♀ at least, is larger than in typical *mulatta*.

Swinhoe sent the type of *sancti-johannis* as a living animal to the Zoological Gardens whence it was transferred to the British Museum. Here it was examined by Anderson and Elliot who left its status unsettled on account of its immaturity. It is a young female, with milk dentition, and measures head and body about 300 mm. (12 ins.), tail 118 mm. (4·7 ins.), hind foot 107 mm. (4·2 ins.). But the length of the body is considerably shortened by a lateral curvature of the spine and contraction of the loins, both associated with rickets. Swinhoe recorded the length of the tail of the newly caught animal as 4½ ins., which was no doubt approximately correct. But Anderson, who measured it on the specimen in alcohol, gave 5½ ins. This is true with the hair at the tip included. From my measurements it will be seen that the tail is only 11 mm. longer than the hind foot; and to show that the shortness of the tail is not a juvenile character I subjoin particulars of the dimensions in millimetres of four young examples of typical *mulatta* from Burma:—

...	1	2	3	4
Head and Body ...	209	270	342	423
Tail ...	157	150	174	240
Hind Foot ...	88	101	114	137

In these and many more, from the newly born up to maturity that I have measured, the tail is always very considerably longer than the hind foot.

Swinhoe's specimen, now made up into a skin, was in full moult when it died. The winter coat, still adherent to the neck, shoulders, flanks and thighs, is long and soft, about 2 ins. long on the shoulders where the hairs are tipped with ochreous brown; on the thighs the tips are much brighter and redder. But the new coat which is fully exposed on the crown and the back from behind the shoulder to the root of the tail is unusually dark owing to the presence of a good deal of blackish pigment in the hair. The under side is buffy white.

The typical example of *littoralis* is an adult ♀ collected at Kuatun by C. B. Rickett in November 1898. A second specimen, a young ♂, was secured by J. de la Touche at the same place on May 12, 1898. Both are in the British Museum and both were seen by Elliot who detected the shortness of their tails but attributed it to injury. The tails are complete and supply the only satisfactory character substantiating the racial status of this form.

Elliot's description does not mention a single feature by which *littoralis* can be distinguished from *mulatta*. He, indeed, referred to it a third specimen in the British Museum received from the Zoological Society as coming from Kashmir. But he dismissed Kashmir as its locality because he thought the specimen belonged to the same kind as the two from Fokien. It does not. It is a thick-coated rhesus with a tail of ordinary length, no doubt came from the country assigned to it, and is practically certainly an example of *M. m. villosa* (cf. *supra*).

The two Fokien specimens exhibit great difference in colour. The female killed in November has the comparatively new coat smooth, of moderate length, with the characteristic reddish annulation on the hairs of the head and shoulders, becoming brighter posteriorly and turning to bright orange red on the outside of the thighs, the legs and feet being washed with yellowish red. The male, collected in May, has the coat still in good condition but considerably longer, rather shaggier and much more olive in hue than in the female. There is, indeed, unusually little red on the hind-back and the brightness of the thighs is buff brown rather than orange, and the lower legs are hardly visibly washed with yellow; but the scrotal hairs are red as in typical *mulatta*. The under side is greyer, less buffy white than in the type.

No measurements in the flesh were taken of these specimens and the dimensions of the head and body in made-up skins are apt to be misleading, owing to stretching. The tail, however, does not stretch to a great extent. In the two specimens the tails measure about 6 inches (150 mm.) and the hind feet, allowing for shrinkage with drying, are at most only a little shorter.

Apart from the very immature type-skull of *sancti-johannis* there are two skulls of this race in the British Museum, both of females and both presented by C. B. Rickett. The skull of the type is that of an adult, but youngish adult, specimen and possibly not quite full-sized. The other is younger. They seem to be a little larger on the average at all events than skulls of typical *mulatta* from India; but the difference does not amount to much. Individually they differ in one or two features worth recording. In the type the orbital sockets are slightly higher than wide, the nose and muzzle are more compressed, the cheek teeth are straighter and the occipital protuberance more truncated. (For measurements, see table under *lasiotus*.)

THE RHESUS OF SZECHUEN.

Macaca mulatta lasiotus, Gray.

Macacus lasiotus, Gray, *Proc. Zool. Soc.*, 1868, p. 61, pl. vi; Anderson, *Zool. Res. Yunnan*, p. 83, 1878; Elliot, *Rev. Prim*, ii, p. 198, 1912 (*lasiotus*).

Locality: Szechuen, S. China.

For many years the only known example of this Macaque was the typical, accidentally tailless,[1] specimen exhibited in the Zoological Gardens and sent to the British Museum in 1871. This was a full-grown male and was tolerably fully described by the authors above quoted, especially by Anderson who gave a figure of the skull with its structural peculiarities.

In 1911 a second specimen, an adult female, was collected by M. P. Anderson, for the Duke of Bedford's expedition, in the mountains 30 miles S. of Kia-ting, Sze-chuen, at an altitude of 2,900 ft. on a bush-covered precipice. This specimen was referred to by Thomas (*Proc. Zool. Soc.*, 1912, p. 128) as an unidentified *Simia* of the *rhesus*-group.

There is no doubt whatever that this female is *lasiotus* and it possesses a well developed tail. It was shot on February 6th, 1911, when in fuller winter coat. But the coat is not particularly long or thick and is not at all shaggy or woolly. It is about the same in length and consistency as in Delacour's Tonkin specimens shot in December, but the tail is exceptionally well haired, the hairs increasing in length from the base to the tip. The general colour is decidedly dark, the under hair of the upper side and outside of the limbs being everywhere deep slate grey, especially dark and sooty on the back. The hairs of the head and shoulders are annulated with rusty yellow which increases in amount and intensity posteriorly and becomes bright rusty on the thighs. The arms and hands are very deep brownish olive grey, and faintly annulated; the legs like the thighs but paler and the feet are paler still and greyer. The under side is a dirty grey. The cheeks are rather dark and there is a good deal of black hair round the face.

The male, which died in May, is also in good coat and very like the female in colour, although a little darker and rustier brown on the thighs and with a decided wash of reddish on the belly.

The measurements of the skin of the young-adult female taken in the flesh by Malcolm P. Anderson, indicate a Macaque by no means unusual in size, the head and body being 490 mm. (=19 3/5 ins.) and the tail 260 mm. (=10 2/5 ins.). But the tail is unusually long, exceeding half the length of the head and body. It does not approach that on the dried skin, falling short of half the head and body even with its long terminal hairs included.

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[1] In another example assigned to this race and shipped from Shanghai to the Zoological Society, where it arrived in Jan. 1880 and died in June 1881, the tail is represented by a stump about half an inch long. The June coat is longer, coarser, more distinctly annulated and paler grey at the base, with the rump redder in the two known definitely to have come from Sze-chuen. This skin would pass anywhere for typical Indian *M. m. mulatta*.

The skull of the ♂, figured and described by Anderson is heavy, massive and exceptionally broad across the orbits and zygomata, the latter and the lower part of the orbital rim being also exceptionally stout. Although the sutures are everywhere faint, the teeth are hardly worn; but the canines have been cut off short as is a common custom with male monkeys in captivity. Apart from its greater massiveness and breadth, to which Anderson attached considerable importance in separating *lasiotus* specifically from *mulatta* (*rhesus*), the skull differs from those of adult and old males of *mulatta* in the great distance between the temporal ridges on the parietal bones where they are more widely separated than on the frontals. In skulls of typical *mulatta* of about the same age these crests lie near together over the parietals where they are closer together than on the frontals. But I mistrust all these features because the monkey had been in captivity an unknown length of time, probably many years, since it is improbable that it was captured as an adult animal. Captivity alters monkey skulls in a variety of curious ways, excessive weight of bone often being one of them; and if during its cage-life this macaque used its jaws less than a wild monkey by being fed, maybe, on softer food, we get the explanation of the widely separated temporal crests.

The skull of the female has the sutures very clearly defined, no trace of the temporal crests and perfect unworn teeth. It is probably neither quite full sized nor fully developed since it has a shallower upper jaw and less pronounced, more sloping brow-bridge than in full grown examples of typical *mulatta*. It exhibits a peculiarity in the comparative flatness of the parietal region of the skull imparting an unusual prominence to the occiput. This I regard as an individual peculiarity since a very similar variation occurs in a female skull of typical *mulatta* from the Mishmi Hills, Assam, and is exhibited more or less in others

Racially this Chinese Macaque may be distinguished from the Indian by its darker colour, probably larger size and bushier, perhaps longer tail.

Skull measurements of *M. m. sancti-johannis* and of *M. m. lasiotus*.

Locality and Sex	Skull in inches.				Teeth in mm.		Remarks
	Total Length	Zygom. Width	Orbital Width	Width of Maxilla	Upper Cheek Teeth	1st Upper Molar	
Fokien, ♀	4·7	3·3	2·7–	1·5+	32	8×8	Type of *littoralis*.
,, ♀	4·6	3	2·5	1·6	34	8×8+	
Szechuen, ♂	5·3	3·9	3·3	1·7+	34	9×8	Type of *lasiotus*.
,, ♀	4·7	3·1	2·6	1·6	34	8×8	

THE RHESUS OF NORTH CHINA.

Macaca mulatta tcheliensis, M.-Edwards.

Macacus tcheliensis, A. Milne-Edwards, *Rech. Mamm.* p. 227, pls. xxxii and xxxiii, 1870.

Locality: The mountains to the east of the Province of Tche-li, N. China.

Milne-Edwards himself when describing this Macaque suggested the possibility of its belonging to the same species as *lasiotus* from Szechuen. This suggestion was adopted as a certainty by Anderson in 1878 and since then its name has figured, but quite wrongly, in the synonymy of the Szechuen form.

There seems to be nothing to justify that view in the original description of *tcheliensis,* which is evidently a much paler animal than *lasiotus*; but the artificial basal truncation of the tail in the type and only known specimen of *lasiotus* obscured the principal difference between the two.

M. m. lasiotus, as recorded above, has the tail at least as long as in typical *mulatta,* whereas M.-Edward's recorded measurements of the type of *tcheliensis* and his illustration of the animal show that the tail is only about one third the length of the head and body and a fraction longer than the hind foot. In this respect the Tcheli Rhesus very closely resembles the Hong Kong or Fokien Rhesus (*M. mulatta sancti-johannis*).

Milne-Edwards described his specimen, a female apparently in short summer coat, as being bright reddish fulvous in general hue, with the tail bright yellowish tawny and the hands greyish yellow. The only example I have seen is the skin of an adult male, ticketed 'N. China', presented by the Zoological Society, where it was received in August 1880 and died on March 6th 1881, in the perfect winter coat, long, thick and beautifully soft. On the shoulders the hairs are about 3 inches but towards the axilla they are over 4 inches long and on the head about 1½ inches. The general colour above is brown, ochreous on the head and fore quarters, much brighter and redder on the rump and thighs; but on the fore quarters there is only a faint trace of annulation in the hairs. Beneath their reddish tips the hairs are pallid grey, turning nearly white quite at the root. The cheeks are duskier than the top of the head, the arms are olive grey, unspeckled, the legs and feet washed with dull yellow, the tail is nearly the same tint as the loins but darkening distally and the under side is greyish white except the scrotum which is clothed with reddish hair. On the made-up skin the tail without the hair is 5.2 inches, with the hair 7.6; the feet, not shrunk, are 5.3 inches and the head and body from the crown to the root of the tail 1½ ft.

This male is not so pale apparently as the type described and figured by Milne-Edwards, As compared with the skins of *lasiotus* it may be noted that, apart from the shortness of the tail, this skin from N. China differs in colour and coat, its tint being not so dark, the under fur especially much paler and the coat far longer and more luxuriant than that of the Szechuen female shot in February and also in full winter pelage.

THE SNAKES OF IRAQ.

BY

NORMAN L. CORKILL, M.B., Ch.B., F.Z.S.

Late Iraq Health Service.

In 1927, when the writer was appointed to teach Biology in the new medical college at Baghdad, little appeared to be definitely known about the snakes of the country. There were people who said that no poisonous snakes were to be encountered in Iraq, and others who vouched vehemently to have seen Kraits and Russell's vipers.

The Central Laboratory had, however, identified specimens of *Echis carinatus* and *Vipera lebetina* in connection with snake-bite fatalities and there was in existence a scanty literature.

The literature comprised *Notes on the Animals of Mesopotamia*,[1] a small booklet published by the B.N.H.S. in 1916, a paper in the Journal of the Society by Boulenger in 1920 [2], and a further paper by Miss Joan Procter [3] in the same publication the following year. The information about Mesopotamian snakes in the first of the above is apparently a collection of the relevant data from Boulenger's Catalogue of Snakes in the British Museum.[4] Boulenger's 1920 paper is a list of specimens taken by members of the Mesopotamian Expeditionary Force during the War, and Miss Procter's contribution is a similar and additional list.

Cases of snake-bite, some fatal, kept cropping up, and in most instances the snake was not secured. It was thought worth while to attempt something in the nature of a rough survey of the country's snake population with a view to establishing the species that occurred, ascertaining if there were any peculiarities of distribution or relative abundance, and formulating some simple key or means by which the poisonous species could be identified easily in the field. Moreover it was thought advisable to have a representative collection of specimens in Baghdad.

Officials were written to in the provinces and responded generously with specimens and notes. Searches were made in hospitals and laboratories, and specimens were unearthed from mouldy oblivion on several occasions. The Royal Air Force Medical Service and the British Officers of the Assyrian Levies contributed valuable material and notes, and students provided a further fruitful source. The investigation covered roughly two years, 1928 and 1929, the significance of the data amassed being assessed in mid-1930.

The writer has no claim to any specialist knowledge of snakes and is painfully aware that much information that might have been collected from the hundred odd specimens examined, was lost through lack partly of time, partly of works of reference, but mainly through lack of knowledge. Much has been learnt since farewell was said to the specimens, now in the Zoology Museum of the Royal College of Medicine, Baghdad. However, it has been thought as well to put on record the few additions to our knowledge of Mesopotamian snakes that accrued.

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[1] Bombay Nat. Hist. Soc. : Notes on the Animals of Mesopotamia, 1916.

[2] Boulenger, G. A. : A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

[3] Joan. Procter : Further Lizards and Snakes from Persia and Mesopotamia. *J. B. N. H. Soc.* xxviii, No. 1, 1921.

[4] Boulenger, G. A. : Catalogue of Snakes in the British Museum, 1893-96.

I am indebted, for permission to publish, to the Director of Public Health, Iraq, the Inspector-General of Health Services, Iraq, and the Dean, the Royal College of Medicine, Baghdad.

Modern political Iraq is a land of diverse features. To the north-east, the desert plains of the south and west break up to be replaced by the hills and mountains rising away to Persia. To the south stretches the monotonous plain threaded by the two rivers, away to the Persian Gulf. The course of the River Euphrates is beset with lake and marsh. The great Shamiyah Desert rolls away in a gradual ascent to the west. Extremes characterise the climate; a temperature of 125° F. is a commonplace in the summer in Baghdad, and I have seen frozen puddles on the roads during winter. In Kurdistan, the north and north-eastern portion of Iraq, it is of course much colder in winter.

As might be expected, having regard to the geographical position and physical make-up of the country, its fauna is a jumble. Species that are typically European, African and Asiatic, all occur, and in the waters of the Persian Gulf is found a sea snake (*E. schistosa*) which ranges as far as China and Australia.

It is considered that the twenty-four specimens dealt with below are unlikely to be supplemented in the future. They represent over two years collecting from all parts of the country and the available literature has been utilised. Seven families are represented and fifteen genera. These are Typhlops, Leptotyphlops, Eryx, Natrix, Coluber, Lytorhynchus, Contia, Tarbophis, Malpolon, Psammophis, Enhydrina, Naja, Vipera, Cerastes, and Echis. Of the *Colubrides* there are eleven *Aglyphs* and four *Opisthoglyphs*. The old *Proteroglyphs* are represented by one of the Hydrophiidæ and one of the Elapidæ. The vipers number three. Five of the twenty-four species are considered to have venoms dangerously toxic to man. These species are *Enhydrina schistosa*, *Naja morgani*, *Vipera lebetina*, *Cerastes cornutus*, *and Echis carinatus*.

Family : TYPHLOPIDÆ.

Typhlops braminus, Daudin.—The Common Worm Snake.

Vernacular Names.—It would most likely be spoken of as 'Dood' which is the Arabic for worm.

This species has been recorded from South Africa, Arabia, Southern Asia as far over as the Philippines Island in the Indian Ocean and Mexico. One suspects the last named to be an importation. During the Great War a single specimen was taken in Basra.[1]

The distribution being what it is, there is no reason why *T. braminus* should not be fairly common in Iraq. Its nocturnal and burrowing habits will, of course, provide against its being frequently encountered.

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[1] Boulenger, G. A. : A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

Typhlops vermicularis, Merrem.—The Greek Blind Snake.

Synonyms.—*Typhlops syriacus,*[1] *Typhlops wilsoni.*[2]

Vernacular Names.—Like the preceding species this snake would be spoken of by the Iraqi Arab as a ' Dood ', that is, worm.

Specimens have been recorded from Greece and its Archipelago through the Levant to Persia, Afghanistan and Turkestan.

Iraq may now take its place in this list as two specimens were obtained in 1928 and 1929.

Locality.	Length (ins.)	Rows.	Nasals.	Length : Breadth.	Remarks.
Baghdad ...	9·2	24	Division incomplete.	46 : 1	Purplish brown, belly paler.
Nasiriyah ...	6·5	24	,,	50 : 1	,,

Like *T. braminus*, this species is probably fairly common in the country.

Family : LEPTOTYPHLOPIDÆ.

Leptotyphlops macrorhynchus, Jan.

Synonyms.—*Glauconia macrorhynchus.*[3]

Vernacular Names.—This snake, again, would probably be referred to as ' Dood ', but it would be called a ' Sul ' by some natives who say that the attributes of the latter are thinness, redness, smallness and the ability to jerk about with great activity.

Previous records for the species include North Africa, Sind, Baluchistan and, in Iraq, ' Euphrates ' and ' Faleya ' (Fallujah ?).[4] During 1928–29 three further specimens were taken in the country. Two were revealed during digging operations on the south bank of the Diyala River at Baqubah and the other specimen was secured in Nasiriyah. The species would appear to be uniformly distributed throughout riverain Iraq.

Locality.	Size (ins.)	Rows.	Tail—Total Ratio.	Remarks.
Baqubah ...	7·3	14	1/10	Uniform pink.
Do. ...	8·0	14	1/11	,,
Nasiriyah ...	8·8	14	1/12	Uniform brown.

Family : BOIDÆ.

Sub-family : BOINÆ.

Eryx jaculus familiaris Linnæus.—The Javelin Sand Boa.

Vernacular Names.—' Batra ' is applied to the Sand Boa throughout Arabic-speaking Iraq.

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[1] Jan. : Icon. Oph., p. 15, l. 3, 1864.

[2] Wall. F. : *J. B. N. H. Soc.* xviii, p. 802, 1908.

[3] Boulenger, G. A. : Catalogue of Snakes in the British Museum, 1893-96.

[4] Boulenger, G. A. : A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

The species ranges from Algeria, Egypt, the Levant, Roumania, Greece and Turkey through Asia Minor and Iraq to Persia. In Iraq, specimens have been previously recorded from Basra, Sheikh Saad, Shaiba, Amara, Baghdad and 'Mesopotamia'.[1] In 1928–29 eight more specimens were examined. They came from Baghdad[1], Baqubah[1], Hinaidi and Nasiriyah in the riverain plains, Mandali at the foot of the Pusht-i-Kuh and Sulamainia in the Kurdish hills. The species is apparently uniformly distributed throughout the country.

Locality	Size (ins.)	Ventrals	Caudals	Dorsal Rows	Colour (dorsum)	Tail-Total Ratio	Remarks
Baghdad	26	200	26	51	Greenish yellow with brown markings	1/13	
,,	10·5	200	30	50	,,	1/10	
Hinaidi	19·5	195	28	49	,,	1/13	
Baqubah	25	197	21	47	,,	1/15	Tail mutilated.
,,	32	202	25	51	,,	1/11	
Nasiriyah	18·5	186	30	53	,,	1/11	
Mandali	18	203	31	53	,,	1/10	Markings very heavy.
Sulamainia	10	205	31	51	Pale grey with brown markings	1/10	Belly speckled.

In all specimens the perioculars numbered eleven and the anal scale was undivided. The dorsal scales were invariably keeled posteriorly. The bellies were of a uniform white or pale straw colour with the exception of the Sulamainia specimen which had a heavy speckling of dark brown. The scale counts of ventrals, caudals and dorsal rows average higher than the Egyptian specimens reported by Anderson.

Family : COLUBRIDÆ.

Series : AGLYPHA.

Natrix tessellatus Laurenti.—The Tessellated Water Snake.

Synonyms.—*Tropidonotus tessellatus.*[2]

Vernacular Names.—Known to the Arabs of riverain Iraq as 'Haiat al Mai'.

The distribution of the species is South Europe and Russia, Egypt and the Levant, Asia Minor, Iraq, Persia, Siberia, West China and

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[1] Boulenger, G. A.: A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

[2] Boulenger, G. A.: Catalogue of Snakes in the British Museum, 1893-96.

North-West India. In Iraq specimens have hitherto been recorded from Basra and Fao,[1] and also from Basra, Qualet Saleh, Sheikh Saad, Haqicole, Faleya (Fallujah ?), and Zobeya (Zobeir ?).[2] Fifteen new records were obtained in 1928–29. All had the dorsals strongly keeled in nineteen rows, the anal was invariably divided and the supralabials always numbered eight. In all but three specimens the fourth supralabial only, entered the orbit. Colour varieties were numerous and were not related to size or 'counts' nor was any one colour variety apparently peculiar to any particular locality or type of habitat.

Locality	Size (ins.)	Ventrals	Caudals	Colour	Remarks
Baghdad ...	22	169	58	Jet black. Belly spotted white.	Fourth and fifth supralabials enter eye.
,, ...	29	167	56	Olive. Belly black and white.	...
,, ...	25	166	57	,,	...
,, ...	24	173	60	,,	...
Nasiriyah ...	23·5	169	62	,,	...
,, ...	25·5	171	65	,,	...
Nejaf ...	25	168	61	,,	...
Tuz ...	19	168	66	,,	...
,, ...	19	170	64	Olive with brown markings. Belly black and white.	Fourth and fifth supralabials enter eye.
Baqubah ...	27	170	61	,,	...
,, ...	34	167	55	,,	...
Mosul ...	21	171	66	Olive with brown markings. Belly white.	...
Beled Ruz ...	29	167	73	Olive with brown markings. Belly black and white check.	Third, fourth and fifth supralabials enter eye.
Hinaidi ...	26	172	63	,,	...
Mandali ...	24	169	62	,,	...

This is one of the two commonest snakes in the country and may be seen in numbers almost anywhere in Iraq particularly after the annual floods. I have seen many in pools in the Euphrates near Nasiriyah swimming about vigorously and often with small fish in their mouths. They always assume a very aggressive attitude when approached.

Coluber dahlii Fitzinger.—The Dahl's Whip Snake.

Synonyms.—Zamenis dahlii.

Vernacular Names.—Shares the Arabic name 'Zerrag' with *C. ventrimaculatus.*

This species is found in South Europe, Egypt, the Levant, Asia Minor, Iraq and Persia. In Iraq specimens have been recorded previously from Baghdad.[1] In 1928 a further specimen was secured from a Baghdad garden and in 1929 another was sent in from a garden in Baqubah.

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[1] Bombay Nat. Hist. Soc. : Notes on the Animals of Mesopotamia, 1916.

[2] Boulenger, G. A. : A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

Locality	Size (ins.)	Ventrals	Caudals	Remarks
Baghdad ...	45	2.5	132	Both specimens were olive with white bellies. Anteriorly there were 5 pairs of yellow-edged dark green blotches; the anterior pair had united to form a collar.
Baqubah ...	39	215	133	

In each case the tail was about a third of the body length, there were nineteen rows of scales, the anals were divided and there were eight supralabials, the fourth and fifth of which entered the eye. This snake seems to be quite rare in Iraq.

Coluber diadema Schlegel.—The Clifford's Whip Snake.

Synonyms.—*Zamenis diadema.*[2]

Vernacular Names.—Known to the Arabs of the plains as 'Raqta'.

Clifford's Whip Snake is found in North Africa, Arabia, Iraq, Persia, Turkestan, Baluchistan and Kashmir.

In Iraq specimens have been previously recorded from Basra, Baghdad, Sheikh Saad, Shaiba, Faleya (Fallujah ?), Zobeya (Zobeir ?), Nasiriyah, Baqubah, and Daur.[1] Twelve new specimens were secured in 1928 and 1929.

Locality	Size. (ins.)	Ventrals	Caudals	Rows	Periocualrs	Supralabials	Remarks
Baghdad ..	30	220	72	29	9	11	Olive, darker markings.
,, ...	21	218	74	33	9	11	,, ,,
,, ...	53	226	68	31	7	12	,, ,,
,, ...	49	222	72	31	8	11	,, ,,
Fallujah ...	55	207	60	29	8	11	,, ,,
Nasiriyah ...	52	214	70	31	8	11	,, ,,
,, ...	50	218	74	31	8	11	,, ,,
Samarra ...	36	216	73	31	8	11	Brown, darker markings.
Baqubah ...	46	223	65	31	8	11	Olive, darker markings.
Gebal Hamrin	42	229	68	31	9	11	,, ,,
Khaniqin ...	41	224	65	33	9	11	,, ,,
Sulamainia ...	33	233	87	35	9	13	Pale grey, darker markings.

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[1] Boulenger, G. A.: A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

[2] Boulenger, G. A.: Catalogue of Snakes in the British Museum, 1893-96.

In all of the specimens the anal was divided, the dorsals were keeled, particularly posteriorly; the belly was of a pale uniform straw colour, and the darker markings were heavy and defined. The three longitudinal marks on the head and neck were invariably distinct. The tail averaged a sixth of the total length.

Specimens were taken in such diverse habitats as houses, riverain cultivation, desert and mountain. A small rat was removed from the stomach of a Baghdad specimen.

Coluber jugularis Laurenti.—The European Whip Snake.

Synonyms.—Zamenis gemonensis.[1]

Vernacular Names.—Known to the Arabs of Iraq as 'Arbid' or 'Abrid' i.e. the black snake. It presumably shares the name with the much rarer and smaller *Naja morgani.*

It has been recorded from the West Coast of Europe to South Western Asia. The '*asianus*' variety to which most Iraqi specimens seem to belong is found in Egypt, the Levant, Iraq and Persia. In Iraq specimens have previously been taken in Baghdad, Basra, Amarah, Haqicole and Faleya (Fallujah ?).[2] In 1928–29 further specimens were secured from Baghdad, Baqubah and Nasiriyah, the North of Iraq not being at all represented.

The eight specimens recorded below had their dorsals in nineteen rows, the anal divided and eight supralabials with the fourth and fifth invariably entering the orbit. The tail was a third to a quarter of the total length. The colour of the dorsum ranged from dark brown to black, each individual scale having a pale yellow or white longitudinal streak. The bellies were either red, yellow, or white, blotched and peppered with black, or of a uniform white.

Locality	Size. (ins.)	Ventrals	Caudals	Remarks
Baghdad ...	52	165	104	
,, ...	43	198	124	
,, ...	46	203	92+	Tail mutilated.
,, ...	52	198	100	
Baqubah ...	48	202	98	
,, ...	53	188	107	
Nasiriyah ...	45	193	100	
,, ...	50	198	99	

The 'Urbid' is much feared by the Arabs, possibly on account of its large size and fierceness when cornered, but also I am inclined to think, because it is unlikely to be distinguished from the uniformly black *Naja morgani.* Certainly the latter is not a 'biter' as far as records go but it belongs to a poisonous genus, accidents with it have probably occurred and any 'Urbid' or black snake thereafter would be feared.

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[1] Boulenger, G. A.: Catalogue of Snakes in the British Museum, 1893-96.

[2] Boulenger, G. A.: A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

Coluber ravergieri Menétriés.—Ravergier's Whip Snake.

Synonyms.—Zamenis ravergieri.

Vernacular Names.—Too rare in Iraq to have one. Would probably be spoken of as a 'Zerrag'.

The distribution is Transcaucasia, Persia, Baluchistan and Afghanistan. There are no previous records from Iraq. Two specimens were obtained in the Autumn of 1929, one from a Mosul house and the second from an earthwork near the town. In each there were two pre-oculars and two post-oculars, the anals were divided, the dorsal rows were faintly keeled and numbered twenty-three, and in each case the fifth and sixth labials entered the orbit. The tails were a quarter of the respective body lengths.

In both specimens the three characteristic longitudinal dark lines on the tail were beautifully defined.

Locality	Size (ins.)	Ventrals	Caudals	Supra-labials.	Colour	Remarks
Mosul, House	42	210	98	9	Pink with brown markings.	Markings very defined.
Mosul, Earthworks.	40	210	102	10	Olive with brown markings.	Less so.

The snake is a rarity and Iraq appears to be the westernmost *limit* of *Var. typica*, further West a *Var. nummifer* is found.

Coluber ventrimaculatus Gray.—Gray's Whip Snakes.

Synonyms.—Zamenis ventrimaculatus.[1]

Vernacular Names.—Known throughout Arabic-speaking Iraq as 'Zerrag' and 'Nishab', both words meaning 'arrow' and being applicable apparently to any thin and swift snake. The names would thus be used also of *C. dahlii* and *C. ravergieri.* I have a note to the effect that in Diwaniyah a specimen taken from a date palm was referred to as 'Jaaferiyah'. It is also quite commonly referred to as 'Haiat al Asfar', the yellow snake.

The Bombay Natural History Society[2] gives the distribution as Mesopotamia to India. Wall[3] limits the Indian distribution to the North-West of the Peninsula. Tristram records it from Palestine.[4]

In Iraq previous records are from 'Euphrates (Euphrates Expedition)', 'Mesopotamia' and Fao,[2] also from Basra, Sheikh Saad, Ezra's Tomb (Qurna), Shaiba, Faleya (Fallujah ?), Zobeya (Zqbier?),

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[1] Boulenger, G. A.: Catalogue of Snakes in the British Museum, 1893-96.
[2] Bombay Nat. Hist. Soc.: Notes on the Animals of Mesopotamia, 1916.
[3] Wall, F.: How to Identify the Snakes of India, 1923.
[4] Tristram, H. B.: Survey of Western Palestine, 1883.

Nasiriyah, Baqubah and Daur.[1] Others again from Baghdad and Amarah.[2] In 1928–29 eighteen further specimens were examined out of literal dozens sent in. The localities represented were Baghdad, Basra, Nasiriyah, Nejaf, Diwaniyah, Baqubah Hillah and Tuz Khurmatu.

Locality	Size (ins.)	Ventrals	Caudals	Supra-labials	Touching eye	Remarks
Baghdad ...	32	210	100	9	5—6	
,, ...	14	200	76	10	4—5	
,, ...	41	210	75	10	6—7	
,, ...	14·5	205	93	9	5—6	
,, ...	40	210	99	9	5—6	
,, ...	40	210	93	9	5—6	
Nasiriyah ...	43	211	90	9	5—6	
,, ...	23	209	87	9	5—6	
Basra ...	33·5	204	85	9	5—6	
Nejaf ...	36	220	94	9	5—6	
Diwaniyah ...	40	215	99	9	5—6	Taken in a date palm.
Baqubah ...	39	217	86	9	5—6	
,, ...	41·5	208	82	9	5—6	
,, ...	34	211	100	9	5—6	
Hillah ...	29·5	211	79	9	5—6	
,, ...	35	218	85	9	5—6	
Tuz ..	37	209	93	9	5—6	
Iraq ...	28	211	97	9	5—6	

In all specimens the tail approximated to a quarter of the body length, the dorsal rows numbered nineteen, the anal was divided, and the colours were, dorsally, olive barred crosswise with black, and ventrally a pale straw ground with lateral black spots in a regular series. The nape was invariably heavily marked with a thick black longitudinal line and the vertex of the head usually bore two black markings like 'commas' placed back to back.

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[1] Boulenger, G. A.: A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

[2] Procter, Joan.: Further Lizards and Snakes from Persia and Mesopotamia. *J. B. N. H. Soc.* xxviii, No. 1, 1921.

This snake is extremely common in houses and gardens in Iraq. It feeds on small frogs and lizards. When handled it bites fiercely but of course quite harmlessly. Two natives that were produced on different occasions for me to see because they claimed to be snake-charmers, brought the Gray's Whip Snake with them as their stock-in-trade. It is probably this snake of which the Sumerians have left a record in their word ' Dashna ', a yellow or green snake.

Lytorhynchus diadema Dum. and Bibr.—The Diademed Sand Snake.

Vernacular Names.—Being rare, insignificant and possessed of no notable attribute it has no vernacular name as far as I know.

Its distribution is North Africa, Arabia, Syria, Iraq and Persia. In Iraq specimens have previously been recorded from Shaiba and Faleya (Fallujah ?).[1] At the end of 1929 a further specimen was secured from Rutba in the Shamiyah Desert. The specimen was eleven inches long, the tail being a seventh of the total length. The ventrals numbered 171, the caudals 36, and the dorsal rows 19. The anal was divided. There were eight supralabials of which the fifth entered the eye. There were two pre-oculars. The pupil was circular although, according to the literature, it should be vertically elliptic. The ' bobbin ' shaped rostral was beautifully exhibited. The dorsum was coral-red with thirty heavy black cross bars. The belly was white. A black cephalic blotch was continued through the eyes from the vertex to the corners of the mouth.

Contia collaris Menétriés.—The Collared Dwarf Snake.

Vernacular Names.—None are known of.

The distribution is Caucasus, Syria, Iraq, Persia and Arabia. In Iraq, specimens had previously been recorded from ' Ruins of Nineveh ' [2] and Baghdad.[1] In 1929 two further specimens were obtained. One was taken from the crop of a houbara (*Chlamydotis undulata*), shot in the neighbourhood of Baqubah, and the other was sent from Sulamainia in the Kurdish hills.

Locality	Size (ins.)	Ventrals	Caudals
Baghdad	12	172	62
Sulamainia	10	195	62

In both specimens the tail was a quarter of the body length, the rows numbered fifteen, the anal was divided, and the supralabials numbered seven of which the third and fourth entered the eye. The colour was fawn with the head and neck heavily blotched with black ; the belly was a pearly white.

Contia coronella Schlegel.—*The Syrian Dwarf Snake.*

Vernacular Names.—None known of.

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[1] Boulenger, G. A. : A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

[2] Boulenger, G. A. ; Catalogue of Snakes in the British Museum, 1893-96.

The distribution is Syria, Palestine, Iraq and Persia. In Iraq, specimens have previously been recorded from Shaiba, Zobeya (Zobeir ?) and Faleya (Fallujah ?).[1] In 1928 a specimen preserved in spirit was unearthed from a Baghdad office. It was labelled ' Rutba '.

It was 7·4 inches long, the tail measuring two inches. The ventrals numbered 136, the caudals 45, and the dorsal rows 15. The anal was divided and there were seven supralabials of which the third and fourth entered the eye. There were two post-oculars. The dorsum was a dull brown (spirit specimen) with sixty-three darker regular cross bars, the first one being markedly heavy and forming a collar. The belly was white with a faint suggestion of speckling.

Contia decemlineata Dum. and Bibr.—*The Lined Dwarf Snake.*

Vernacular Names.—None known of.

The distribution is Syria, Palestine, Iraq and Persia. There are no previous records from Iraq, but in 1929 three specimens were received from the Kurdish hills. One specimen had the head and neck destroyed and one had the extremity of the tail missing.

Locality	Size (ins.)	Ventrals	Caudals	Remarks
Sulamainia (alt. 1,300 ft.)	21	171	66	Complete specimen.
Tislaja (alt. 2,500 ft.) ...	21 +	145 +	66	Head and neck destroyed.
Diana (alt. 1,600 ft.) ...	13 +	163	30 +	Tail mutilated.

The tail of the intact specimen was a quarter of the total length, the dorsal rows numbered seventeen and the anal was divided in all three specimens. The two complete heads exhibited seven supralabials with the third and fourth entering the eye, one pre-ocular, and two post-oculars. All three were alike in colouring. The dorsum was a pale fawn with two pairs of longitudinal fine brown lines; a pair running down each side of the back. The individual dorsal scales had barely perceptible, central, paler streaks. The bellies were pearly white.

All three specimens were taken in September in gravelly areas at considerable altitudes.

Contia persica (Anders.)—The Persian Dwarf Snake.

Vernacular Names.—None known of.

The distribution is Iraq and Persia. From Iraq two specimens are recorded[2], one from Kizil Robat and the other from the neighbouring Jebal Hamrin hills.

I am not at all satisfied as to the relationship of *C. collaris* and *C. persica* and would like to examine a larger series of the genus in Iraq. One or two valuable characteristics I unfortunately made no note of at the time when examining the two specimens recorded under *C. collaris*; in colour they were identical.

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[1] Boulenger, G. A. : A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

[2] Procter Joan. : Further Lizards and Snakes from Persia and Mesopotamia. *J. B. N. H. Soc.* xxviii, No. 1, 1921.

Series: Opisthoglypha.

Tarbophis fallax iberus Eichwald.—The Caucasian Cat-Snake.
Synonyms.—Tarbophis iberus.[1]
Vernacular Names.—None known of.

The distribution is Caucasus, Iraq and South-West Persia. Six specimens have previously been recorded from Baghdad and Mesopotamia.[2] In 1928 and 1929 a further eight were examined from Baghdad, Mandali and Khaniqin.

Locality	Size (ins.)	Ventrals	Caudals	Dorsal colour markings	Remarks
Baghdad	44	240	68	46 spots	Light specimen. Third, fourth and fifth supralabials enter eye.
,,	32	217	73	60 ,,	Divided anal. Light specimen.
,,	17	224	91	50 ,,	Dark specimen. Seven supralabials. Belly dark.
,,	16	239	67	(?)	Faded old spirit specimen.
,,	14	237	80	48 ,,	Belly very dark. Third, fourth and fifth supralabials enter eye.
,,	13	232	72	45 ,,	Very dark specimen. Third and fourth supralabials enter eye.
Mandali	21	216	63	47 ,,	Light specimen.
Khaniqin	30	239	31	(?)	,,

The tails averaged a sixth of the total lengths. The rows of dorsals numbered 21 invariably and, with the exception of one specimen (Baghdad No. 2), the anals were all undivided. The supralabials numbered 8 in all specimens but one (Baghdad No. 3) and in five specimens (Nos. 2, 3, 4, 7 and 8) the fourth and fifth entered the eye. The iris was invariably golden. The colour of an adult specimen was pale brownish pink with barely perceptible brown blotches 46 to 60 in number. The bellies were white, blotched, peppered, and marbled, irregularly with black. In the specimens under 20 inches in length, the dorsum was darker and more grey than pink, and the black element very much predominated on the venter, in some cases the venters being practically entirely black. One's first impression on examining the series was that two species were involved but as the proportions and counts agreed, and as all four of one colour type were small, and the other four specimens were all large, and of the other colour type, one is led to suggest that the snake grows lighter as it grows more mature.

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[1] Boulenger, G. A.: Catalogue of Snakes in the British Museum, 1893-96.

[2] Boulenger, G. A.: A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

All specimens were taken in gardens or cultivation except one small one which was found amongst the 'drinks' in a pantry. Five were handled alive and were of a very tranquil disposition. The Khaniqin specimen was killed with a sparrow firmly embedded in its jaws.

Malpolon monspessulana Hermann.—The Montpellier Snake.

Synonyms.—Cælopeltis monspessulana.[1]

Vernacular Names.—None known of definitely. Possibly it is the snake spoken of as 'Hannash.'

The distribution is from North Africa, the Mediterranean and the Adriatic to the Levant, Iraq, Caucasus and Persia. Previously one had been recorded from Baghdad.[2] In 1928–29 nine more specimens were examined all from Northern Iraq, being from Baghdad, Mosul, Tuz Khurmatu, and Suwara Tuka, North of Mosul.

Locality	Size (ins.)	Ventrals	Caudals	Colour	Remarks
Baghdad ...	26	168	55+	Bluish grey with pale-edged darker spots. Belly white.	Tail mutilated. Dorsal rows 19.
,, ...	40	200	104	,,	,,
,, ..	31	176	40+	Olive brown, belly straw.	Tail mutilated.
,, ...	36	186	100	,,	...
,, ...	34	176	84	,,	...
,, ...	30	174	42+	,,	Tail mutilated.
Tuz ...	36	172	90	,,	...
Mosul ...	33	172	29+	,,	Tail mutilated.
Suwara Tuka (alt. 2,000 ft.)	10 5	170	66	Chocolate brown, belly white.	...

In the complete specimens the tail was a quarter of the body length. In all specimens there were eight supralabials of which the fourth and fifth entered the eye. The anal was invariably divided.

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[1] Boulenger, G. A.: Catalogue of Snakes in the British Museum, 1893-96.

[2] Boulenger, G. A.: A List of Snakes from Mesopotamia, *J. B. N. H. Soc.* xxvii, No. 2, 1920.

The dorsals were always deeply grooved. Numbers 1 and 2 in the list would appear to be var. *insignitus* [1] and the others var. *neumayeri.* [1] It is remarkable that no fewer than four of the nine had mutilated, that is abbreviated, tails. Most of the specimens came from gardens or cultivation. Four of the six Baghdad specimens came from the highly cultivated Rustum Farm, south of Baghdad, a place with a considerable rodent population.

Malpolon moilensis Reuss.—The Moila Snake.

Synonyms.—Cœlopeltis moilensis.[2]

Vernacular Names.—None known of.

The distribution is North Africa, Syria, Arabia, Iraq and Persia. In Iraq, specimens have been recorded from Sodom, Sheikh Saad and Shaiba.[3] No fresh specimens were seen in 1928 or 1929.

Psammophis schokari Forskal.—The Variable Sand Snake.

Vernacular Names.—None known of.

The distribution is from North Africa to Arabia, Syria, Palestine, Iraq, Persia, Baluchistan, Afghanistan and Sind. In Iraq, specimens had previously been recorded from Basra and Shaiba.[3] In 1929 a further specimen was brought in from Rutba in the Shamiyah Desert.

The specimen was a young snake, twelve inches long with an olive dorsum streaked with two dark longitudinal bands. The belly was edged longitudinally with the characteristic interrupted lines. The ventrals numbered 183, the caudals 96 and the dorsal rows 19. The anal was divided, and of the nine supralabials, the fifth and sixth entered the eye.

Apparently quite a rarity in Iraq.

Family : HYDROPHIIDÆ

Enhydrina schistosa Daudin.[4]—The Hook-nosed Sea Snake.

Synonyms.—Enhydrina valakadyen.[5]

Vernacular Names.—None known of.

The distribution is given by Malcolm Smith as from the Persian Gulf to the coast of Cochin-China and the North Coast of Australia. None have been reported from the waters of the Persian Gulf that wash the coastal extremity of Southern Mesopotamia, but in 1929 four snakes were discovered in spirit in the Laboratory at Rustum Farm, Agricultural College, Baghdad. They were labelled '*Hydrophis cyanocincta*—Persian Gulf' and were assumed to be duplicates of the 1921 Cox Cheeseman collection.

No helpful literature was available in Iraq at the time and in consequence very few particulars relating to the specimens were looked for and recorded. However the rows numbered 54 at mid-body, the rostral projected over the lower jaw, the ventrals were barely differentiated, and the individual scales were not imbricate; they bore the faintest suggestion of a short central keel. The colour was dull olive barred with black dorsally. It was decided that the specimens approximated more to *Enhydrina schistosa* and they were so labelled.

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[1] Boulenger, G. A. : The Snakes of Europe, 1913.

[2] Boulenger, G. A. : Catalogue of Snakes in the British Museum, 1893-96.

[3] Boulenger, G. A. : A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

[4] Smith, Malcom. : Monograph of the Sea Snakes, 1926.

[5] Gray. : Catalogue of Snakes in the British Museum, 1849.

An engineer from one of the dredgers employed at the bar of the Shatt-el-Arab off Fao told me that it was not uncommon for sea-snakes four feet in length to be emptied out in the contents of the sludge buckets of the dredger. He said that these snakes were green with black cross-brands and were known to the native crew as being poisonous.

The following additional species of Hydrophiidæ have been recorded from the Persian Gulf: [1]

Thallasophina viperina Schmidt.—Persian Gulf and Muscat.
Hydrophis spiralis Shaw.—Persian Gulf, Gangestum and Muscat.
Hydrophis cyanocinctus Daudin.—Persian Gulf.
Hydrophis ornatus Gray.—Muscat.
Hydrophis lapemoides Gray.—Persian Gulf and Jask.
Lapemis curtus Shaw.—Muscat.
Microcephalophis gracilis Shaw.—Persian Gulf and Gulf of Oman.

Family: ELAPIDÆ

Naja morgani, Moquard. —The Hoodless Cobra.

Synonyms.—Atractaspis wilsoni.[2]

Vernacular Names.—It shares the names 'Urbid' and 'Abrid', that is, the 'black snake' with *C. jugularis* var. *asianus.*

The recorded distribution is Persia and Iraq. Specimens have previously been taken in Shaiba and 'Mesopotamia'. [3]

In 1928 and 1929 five further specimens were secured from Mosul [3], Baqubah, Mandali, and Rutba in the Shamiyah Desert.

Locality	Size (ins.)	Ventrals	Caudals	Rows	Anal	Remarks
Mosul ...	12	185	46	21	1/1	Uniform black.
,, ...	25	183	43	21	1	,,
Baqubah ...	26·5	185	44	21	1/1	Purplish brown, belly paler.
Mandali ...	29	185	30+	23	1	Tail mutilated. One preocular, two postoculars. Uniform black.
Rutba ...	22	182	45	21	1/1	,,

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[1] Smith, Malcom.: Monograph of the Sea Snakes, 1926.

[2] Wall, F.: *J. B. N. H. Soc.* xviii, p. 804, 1908.

[3] Boulenger, G. A.: A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

In the six complete specimens the tail was a sixth to a seventh of the total length. There were invariably seven supralabials with the third and fourth touching the eye. The third also touched the nasal. Unfortunately the periocular scales were not noted in four specimens, nor were the caudals closely examined in any. These gave the impression in every specimen of being divided but a photograph in the writer's possession suggests that a number, six or so, of the more immediately proximal caudals were entire.

It is interesting to compare this cobra with *Walterinnesia ægyptia*, Lataste[1] of which five specimens are known, all recorded from Egypt. Two only, however, are reputed to have their exact provenance known. These were caught on the Cairo-Suez Road. In 'counts', proportions and colouration the two species *N. morgani* and *W. ægyptia* appear to more or less agree. There remains however the generic obstacle in the absence of small teeth behind the fangs in the *Walterinnesia* type specimen. Mr. H. W. Parker of the British Museum was good enough to examine the type specimen and was of the opinion that if a further examination of *Naja morgani* revealed an agreement with *Walterinnesia* in other externals, such as keeling of the posterior dorsal scales; proportion, numbers and distribution of the periocular; and the variation in the division of the caudals, then a dental dissection ought to be made to verify the generic validity of *Walterinnesia*. I am awaiting with interest the opportunity to again examine specimens.

Naja morgani is apparently uniformly distributed throughout Iraq and is not uncommon. It may be found in various habitats and is by no means shy. The young Mosul specimen was picked up on a tennis court. The adult emerged daily from a hole in the gateway of the Mosul Civil Hospital to glide about amongst the waiting patients. This went on for months and the snake enjoyed a certain status as a sort of 'divan habituè' until one day, a request for snakes having been received, he was killed, bottled, and sent in. The Baqubah specimen was brought up alive from a bricked well by an enthusiastic chauffeur. He was passed round an appreciative and inquisitive circle before being killed, pickled, and passed on. Though he hissed very angrily he is said not to have attempted to bite, even when freely handled. The Mandali specimen was taken on a track near cultivation and the Rutba specimen came from the desert. I know of no records of snake-bite by this species or *W. ægyptia* but presume that its genus alone should be sufficient to procure it respect.

Family : VIPERIDÆ.

Sub-family : VIPERINÆ.

Vipera lebetina, Linnaeus.—The Levantine or Blunt-nosed Viper.

Synonyms.—*Vipera euphratica*,[2] *Daboia xanthina*.[3]

Vernacular Names.—In spite of the fairly frequent occurrence of this snake and of its reputation, I could not get hold of a name for it.

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[1] Lataste : Le Naturaliste, p. 411, 1887.
[2] Martin : Proceedings Zoological Society of London, 1838.
[3] Gray : Catalogue of Snakes in the British Museum, 1849.

Everyone north of Baghdad knew of it and could describe it. It was always spoken of as being deaf. On one occasion a Mosuli described it surprisingly well as 'a dangerously poisonous snake, with a thick body and a thin neck, a tail like a cigarette, of a brown colour, and blind and deaf'. In Cyprus the snake is known as 'Koufi', a Greek derivation meaning deaf. I understand that in ancient Assyria (Mosul and area) a word 'Kuppu' was used in application to a 'terrible snake'. In the Mosul area to-day an inquiry as to the 'deaf snake' would, I think, instantly bring descriptions of the Levantine Viper. However, I was unable to collect a definite name.

The distribution is from North Africa, Greece and Cyprus to the Levant, Transcaucasia, Iraq, Persia and North-West India. In Iraq, specimens have previously been recorded from Baghdad and Aushuru (?).[1] During 1928, 1929 and early 1930 seven more specimens were examined; all of them from places in the north-east of Iraq, namely Sulamainia, Mandali, Mosul, Baqubah, Jebal Hamrin, Qaragan and Barazan on the Greater Zab River.

Locality	Size (ins.)	Ventrals	Caudals	Dorsal rows	Remarks
Sulamainia ...	12	173	52	27	Very dark; young specimen.
Mandali ...	22	150	44	23	...
Mosul ...	24	181	48	25	Bit man, result recovery.
Baqubah ...	38	162	38	25	...
Jebal Hamrin ...	40	164	47	23	Bit man, result fatal.
Qaragan ...	25	176	53	23	...
Barazan (Greater Zab)	38	173	46	25	...

In all specimens the tail was about a seventh of the body length. The scales were invariably strongly keeled, the anal was always single and ten supralabials were constant. The colour ranged from dark olive in the smallest specimen, with clear cut darker markings, to pale grey or brownish grey with less defined markings in the largest specimens. The larger the snake the lighter the colour. The bellies always exhibited the characteristic viperine speckling.

Mr. J. Parlby once spoke to me of having seen a snake answering in description to *V. lebetina*, travelling downstream in the Diyala River near Qaragan.

Vipera lebetina seems to be confined to the hills and broken country north-east of Baghdad. There is no record of *E. carinatus* thereabouts and only one of the nine *C. cornutus* recorded below for Iraq, came from this region. There are no other vipers occurring in Iraq. Out of seventeen cases of bite (viperine type) by unidentified snakes no fewer than fourteen came from this area as did also two cases in which the snake was identified as *V. lebetina*. It rather looks as though the majority of snake-bite accidents in Iraq are caused by this viper. If this is correct, then the mortality from its bite would be forty-four per cent, seven deaths in sixteen cases. This is a high percentage, but, that it is quite possibly of true significance is suggested by the widespread fear in which the 'deaf snake' is held in the country north and east of Baghdad.

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[1] Boulenger, G. A.: A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

It is spoken of as being deaf and blind on account of its sluggishness and torpidity by day, a characteristic also, I understand, of its congener the Indian Daboia, *V. russelli*. If shouted at or threatened with a stick it is said to show no perturbation whatever.

Cerastes cornutus Linnaeus.—The Horned Viper or Asp.

Vernacular Names.—'Efa' and an apparent corruption 'Al Fiyah' appear to be applied in Iraq to all noxious snakes, more particularly vipers, and most particularly to the Horned Viper. 'Qarna' and 'Um Grun' are also used referring to its horns and I have heard it discussed and described in the Muntafik Liwa as 'Um Jenaib' in reference to its peculiarity in coiling (i.e. moving) to a flank, with its head poised and threatening to the front. 'Abu Jenaib' is used of the local fresh-water crab.

The distribution is North Africa, Arabia, Palestine, Syria and Iraq. It is figured on the monuments of ancient Egypt, Babylonia, and Assyria. In Iraq previous records, six in number, all of hornless specimens, were from Basra and Shaiba.[1] In the period 1927–30, three more records were obtained, all of horned specimens. One from Nebr in the Muntafik area lived in the writer's possession for seven months. Another was responsible for a fatality in Dohuk, North of Mosul, and the third specimen came from Rutba, in the Shamiyah Desert.

Locality	Size (ins.)	Ventrals	Caudals	Rows	Remarks
Nebr ...	15	...	...	...	No counts done. Lived in writer's possession for over seven months.
Rutba ...	15	144	37	29	Anal single, supralabials thirteen.
Dohuk ...	30	...	...	...	No counts done. Bit a man who died in 24 hours.

The characteristic flat triangular 'ace of spades' head was notable in both specimens seen. The Dohuk specimen was reported by the relatives of the bitten man as being about four-hand spans long, as having horns, and as having a thick body and a broad head.

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[1] Boulenger, G. A.: A List of Snakes from Mesopotamia. *J. B. N. H. Soc.* xxvii, No. 2, 1920.

Incidentally this is the only record I know of in which death has resulted from Cerastes bite. The other eight specimens of this snake came from the desert plains to the south and west but I feel that the Dohuk fatality rings true and should be accepted although no doctor saw the victim alive, or the snake.

Echis carinatus Schneider.—The Saw-scaled Viper.

Vernacular Names.—None known of. Would probably be spoken of as ' El Efa.'

The distribution is from North Africa, Syria and Arabia to Iraq, Persia and India. In Iraq one has previously been recorded from Imam Hamza in the Diwaniyah area.[1] This was in 1924, the specimen being responsible for a fatality. Since that date four further cases of snake-bite have occurred in the same region. In three instances followed by recovery, the snake was identified as *Echis carinatus*. In the fourth case which terminated fatally the snake was not seen and although for various reasons I consider that the snake must have been an *Echis*, I do not record it as such here as this paper is intended to be more or less purely zoological and should take note only of snakes actually identified.

Locality	Size (ins.)	Dorsal Rows	Colour	Remarks
Imam Hamza ...	16	25 keeled	Characteristic broad arrow	Fatal bite.
Diwaniyah ...	...	No particulars recorded	...	Bite—recovery.
,, ...	...	,, ,,	...	,, ,,
Khan Judwhal	...	,, ,,	...	,, ,,

It is notable that all these four specimens came from the Middle Euphrates and none from elsewhere in Iraq.

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[1] Sinderson, H. C. : Snake Bite in Iraq. *Edin. Med. Journal.* Nov., 1924.

The conclusions of this rather superficial survey may be conveniently tabulated as follows.

Species	Distribution in Iraq	Number of new specimens	Remarks
TYPHLOPIDÆ			
1. T. braminus ...	Basra	*Nil*	...
2. T. vermicularis ...	Riverain Iraq	2	New for Iraq
LEPTOTYPHLOPIDÆ			
3. L. macrorhynchus ...	Riverain Iraq	3	...
BOIDÆ			
4. E. jaculus familiaris.	Iraq including Kurdistan	8	Colour variety in Kurdistan
COLUBRIDÆ			
Aglypha			
5. N. tessellatus ...	Throughout Iraq excluding Kurdistan	15	...
6. C. dahlii ...	Baghdad area	2	...
7. C. diadema ...	Throughout Iraq including Kurdistan	12	Colour variety in Kurdistan
8. C. jugularis ...	Riverain Iraq	8	Var. asianus
9. C. ravergieri ...	Mosul	2	New for Iraq.
10. C. ventrimaculatus ...	Riverain Iraq	18	...
11. L. diadema ...	Western Iraq	1	...
12. C. collaris ...	Northern Iraq and Kurdistan	2	...
13. C. coronella ...	Western Iraq	1	...
14. C. decemlineata ...	North East Iraq and Kurdistan	3	New for Iraq. A mountain species ?
15. C. persica ...	North East Iraq	*Nil*	Relationship to C. collaris ?
Opisthoglypha			
16. T. fallax iberus ...	Iraq excluding Kurdistan	8	Young darker than adults

Species	Distribution in Iraq	Number of new specimens	Remarks
17. M. monspessulana ...	Iraq and Kurdistan	9	Var. insignitus and Var. neumayeri
18. M. moilensis ...	Southern Iraq	*Nil*	...
19. P. schokari ...	Western Iraq	1	...
HYDROPHIIDÆ			
20. E. schistosa ...	Persian Gulf. Possibly Shatt-el-Arab	4	No records of bite. New for Iraq.
ELAPIDÆ			
21. N. morgani ...	Iraq as far North as Mosul	5	No records of bite. Possibly related to W. ægyptia.
VIPERIDÆ			
Viperinæ			
22. V. lebetina ...	North East Iraq and Kurdistan	7	Two cases of bite—one death. Probably responsible for many more.
23. C. cornutus ...	Iraq as far North and East as Dohuk (Mosul)	3	One case of bite—one death. First horned specimens from Iraq.
24. E. carinatus ...	Middle Euphrates	4	Four cases of bite—one death.

FLOWER-BIRDS AND BIRD-FLOWERS IN INDIA.

BY

SALIM A. ALI.

(With four plates and four text-figures.)

Hermann Müller, one of the most noted pioneers in the study of the fertilization of flowers, summing up our knowledge on the subject, avers that although self-fertilization by itself may suffice for the propagation of organisms for an unlimited number of generations producing healthy and fertile offspring, yet, as has been proved by the researches of botanists, whenever plants which are the offspring of self-fertilization are opposed in the struggle for existence to the offspring of cross-fertilization, the latter have the advantage. Thus it becomes evident that all peculiarities which aid cross-fertilization will be retained and perfected by natural selection.

The importance of bees, butterflies and a host of other insects in the cross-fertilization of flowers is well known, but the significance of birds in the same capacity has been consistently underrated. It is a subject which has hitherto received no attention whatsoever from workers in India inspite of the vast opportunities the country offers for observation and study, and my purpose in writing this paper is merely to arouse a general interest in the subject, and broadly indicate its possibilities.

To my mind, this branch of research lies more within the sphere of the field ornithologist than in that of the botanist, and the reason is not far to seek. The ornithologist, even though he may know nothing whatsoever of botany, will seldom have much difficulty in collecting specimens of the flowers on which he has observed bird visits, and in having them identified subsequently. The botanist, similarly placed, will be left in doubt as to the identity of the visiting bird as it ceaselessly hops and flits about among the blossoms or darts off to another tree, and will seldom have the means at hand of getting a satisfactory determination of its species. The result will often be that the botanist's record will remain incomplete and, as such, valueless from the scientific point of view.

While it is but rarely that an ornithologist also possesses sufficient competence in botany to be able to conduct research of this nature without the aid of a specialist, and vice versa, an intimate co-operation between the two is clearly indicated for obtaining optimum results. Although this paper does not claim to be any more than merely casual notes of observations in the field, I could not have written it without constant help in identifications, suggestions and advice principally from the Rev. E. Blatter, S. J., but also from a number of other botanists with whom I have been in constant correspondence, to all of whom my best thanks are due.

I am also greatly indebted to Professor Dr. Otto Porsch of the Hochschule für Bodenkultur, Vienna, for kindly placing at my disposal the separata of his recent excellent publications on Ornithophily from which I have taken the liberty to quote freely.

It must be borne in mind that the mere fact of a bird being casually seen on a flower is by itself no evidence of the fact that the flower is ornithophilous or that the bird is an agent in its cross-pollination. But if it is repeatedly observed that a particular species of bird is partial to a particular species of flower and frequents them regularly; that the object of its visits is obviously the nectar situated deep down within the flower-tube; that the structure of the corolla and the position of the essential organs—the stamens and the style—are such that in its endeavours to get at the honey, the head, breast or other portions of the bird's anatomy might reasonably be expected to come into contact with them, then alone can we have justification for assuming that that particular flower *may* be wholly or in part bird-pollinated. To prove the correctness of this assumption, it will further be necessary to secure the bird and subject its plumage to a microscopic examination for adhering pollen. As Neger points out in his excellent summary of Ornithophily (9) it is in a great measure due to the wild generalizations based on insecure premises made in the past that discredit has been brought on the value and importance of birds as agents in the cross-pollination of flowers, and it therefore now behoves workers to exercise special care and attention in the observations they record.

The most highly organized bird-flowers as we find them to-day present certain well-marked characteristics which serve to differentiate them in a general way from flowers fertilized by insects, wind or other agencies. The most important of these are:

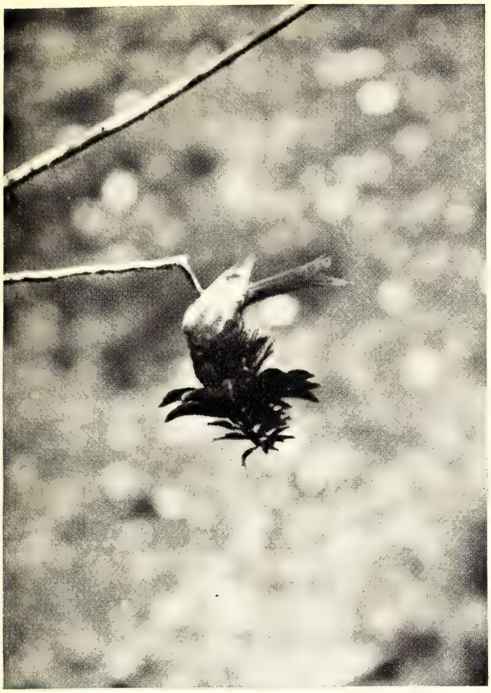
(1) Their structure and pollenizing mechanism is such as to render the transfer of pollen possible only through visits of birds to the nectar.

(2) They usually possess bright and conspicuous colours such as crimson or scarlet, yellow, white, bright blue, also brown and others, which react on the keenly-developed colour-sense and sharp eyesight of the feathered visitors. Experiments have shown that red is the most attractive colour to birds.

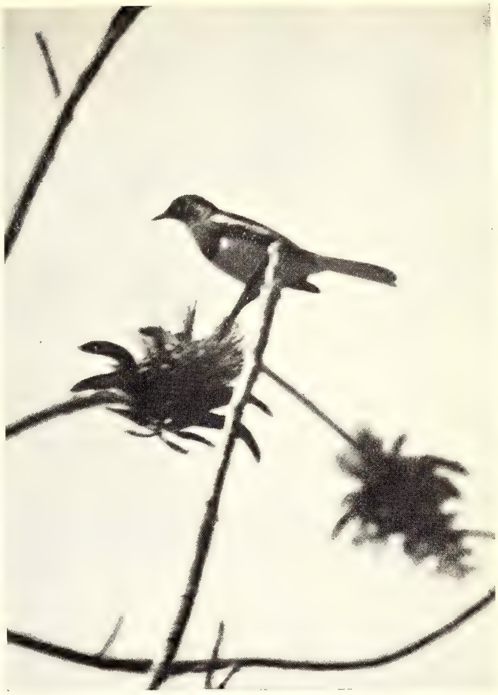
It is also worthy of note that the colours of many bird-flowers are not infrequently reproduced in the plumage of their bird-visitors. I was particularly struck by this in the case of a Yellow-backed Sunbird (*Æthopyga siparaja vigorsi*) recently observed at Lingmala (near Mahableshwar) on the scarlet blossoms of *Hibiscus Rosa-sinensis*, whose breast and upper plumage harmonized with the brilliant colour of the flowers to perfection.

(3) The absence of scent is a feature of the most highly adapted bird-flowers. This dovetails as it were with the completely absent or extremely ill-developed sense of smell in birds, especially in the order *Passeres*.

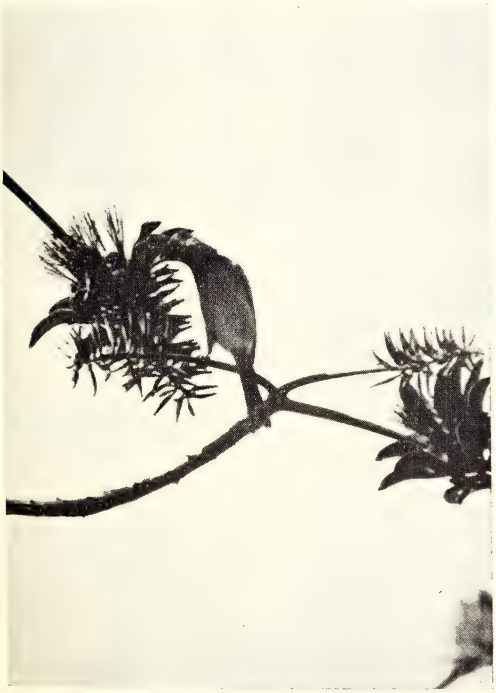
(4) Their richness in honey production. The nectar which is rich in carbohydrates, is highly nutritious and provides both meat and drink to the birds. Their visits to flowers are without doubt largely with the object of quenching their thirst. The origin of the nectar-eating habit is clearly suggested in the habit, commonly noticeable in arboreal birds, of quenching their thirst from dew or rain-drops



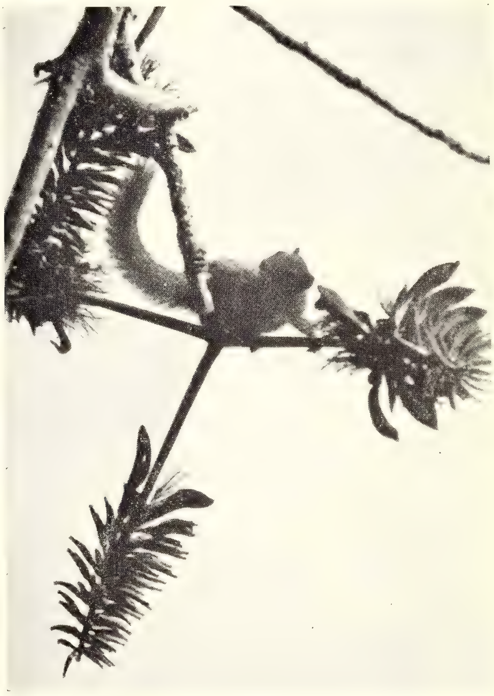
1. **Drongo** (*Dicrurus macrocercus*).



2. **Dhyal** (*Copsychus saularis*).



3. **Red-vented Bulbul** (*Molpastes cafer*).



4. **Striped Squirrel** (*Funambulus tristriatus*).

SOME POLLINATING AGENTS OF *Erythrina Indica.*
(*Photos by Author.*)

collected on the foliage of trees. In the warmer regions of the globe where there is often a scarcity of water in the hot-weather months, the nectar of flowers constitutes a great boon to thirsty birds. It will be seen from the following list that the flowering season of a great many species closely corresponds with the season of drought i.e. between the cold weather and the S.-W. monsoon.

(5) True bird-flowers may, as a rule, be recognized by the absence of broad 'rims' or lobes which serve as an alighting place to visitors in entomophilous flowers, but hinder the access of birds to the nectar.

There are a great many flowers with structure and characteristics intermediate between typical bird- and typical insect-flowers. Among Indian species, for example, *Amherstia nobilis*, *Poinciana regia* and *Poinciana* (*Cæsalpina*) *pulcherrima* show adaptations for ornithophily as well as for entomophily, and are visited both by birds and by insects. There are many species of flowers which in their native land are fertilized by insects as well as by birds, while even these may be fertilized in one locality exclusively by birds and in another exclusively by insects. In Natal, for example, according to Scott-Elliot, the pollen of Musa is usually transferred by the *Cinnyridæ*, and more rarely by bees, whereas in Mauritius on the contrary, bananas are said to be pollinated by insects. While a great many flowers are visited and doubtless also fertilized to some extent by birds (the magnitude of whose services is on the whole incalculable), it is not unlikely that in India at least the number of species dependent for their pollination *exclusively* upon birds is comparatively small.

As regards the origin of ornithophilous flowers, one comes across assertions in literature so often to the effect that these have evolved from entomophilous forms that it would appear as though this were an established fact. Schnarf (*15*), in particular, often refers to flowers transitory between entomophilous and ornithophilous forms. Werth (*21*) points out that, as long as statements of this kind are confined to specific examples and not implied in a general way, one can have nothing against them, and after discussing various species he comes to the conclusion that although certain ornithophilous flowers can be admitted to have evolved from entomophilous forms, in others (e.g. some *Erica* species) the process can clearly be demonstrated to have been the reverse. Fossils of ornithophilous forms have been discovered dating back to a geological period where flowers with as yet only the first entomophilous adaptations are met with. Further, Werth mentions that among the Angiosperms, wind-, insect- and bird-flowers, as well as well-established flower-insects and flower-birds are all met with at the same time in the lowest chalk stratum of the earth.

In our own day bird-flowers are distributed throughout the tropics and sub-tropics of both hemispheres ; in other words the number of ornithophilous flowers is greatest where representatives of the most highly-organised flower-birds occur : the Humming-Birds (*Trochilidæ*) and Sugar-Birds (*Cærebidæ*) in tropical America, the *Nectariniidæ*, *Dicæidæ* and *Zosteropidæ* in the tropics and sub-tropics of the Old World, and the *Meliphagidæ* and *Trichoglossidæ* in the Australian Region.

There has been a tendency to attribute the object of birds' visits to flowers solely or chiefly to a search after the attending insects, and the importance of the honey has been unwarrantably belittled. As I have pointed out elsewhere (*J.B.N.H.S.*, vol. xxxv, pp. 145-46), there seems no reason for doubting that the visits of specialized birds to the flowers of their choice may be exclusively in quest of the nectar. As mentioned before, flower-nectar is rich in carbohydrates and provides excellent nutriment, and the fact that Sun- and Humming-birds have been kept in captivity for weeks on end on an exclusive diet of syrup, proves the comprehensiveness and all-sufficiency of this class of food. That birds may, in addition, supplement their diet by any little insects that happen to be present on the flowers, is of course self-understood. With a little practice in the field, it is not difficult to determine whether a bird's quest on a flower is the nectar or the attending insects. The deliberate and systematic probing of the bill deep into the corolla-tube for nectar is a process quite distinct from the casual hunt for insect visitors. For instance, no one could fail to differentiate between the behaviour of an Iora on the flowers of the Coral Tree and that of a Myna. The former visits the flowers mainly, if not entirely, for the little insects, while the latter is a confirmed nectar-bibber.

Having indicated the chief peculiarities of the true bird-flowers, it will not be out of place to mention some outstanding characteristics of the typical flower-birds. I confine my remarks to our Indian representatives, the pride of place amongst whom must unquestionably go to the *Nectariniidæ* (Sun-birds). On account of their resplendent plumage, specialized bill and tongue, and their lively and flower-haunting habits, this group has been called the Humming-birds of the Old World. Among all the Passerine birds with a honey diet, the *Nectariniidæ* (along with the *Meliphagidæ*, *Cœrebidæ* and many of the *Drepanididæ*) possess the most highly organised 'mouth-parts'. The bill is long, slender, decurved and more or less cylindrical. The edges of the tongue are rolled upwards and inwards and meet to form a closed tube which functions as a suctorial organ, and usually terminates in a bifurcation (Fig. 1). The tongue, moreover, is extensile and capable of being projected much beyond the tip of the bill. I once watched a *Leptocoma lotenia* which seemed to have a long slender and wriggling worm held endwise in its beak. The glasses showed that this was the bird's tongue which it shot out several times and as rapidly withdrew, remarkably after the fashion of a snake. The organ projected quite a third to one-half the length of the bill beyond the tip of the latter. All the members of this family are furnished with tongues following this characteristic pattern, and eminently adapted for a diet of nectar from flowers.

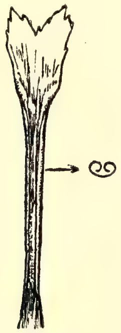


FIG. 1.
Tongue of *Leptocoma zeylonica.*

The families next in importance in India as flower-frequenters are the *Zosteropidæ* (White-eyes) and the *Dicæidæ* (Flower-peckers) whose tongues show half-way stages between the normal general-purpose pattern possessed by the majority of Passerine birds with omnivorous diet, and the highly specialized suctorial organs of the *Nectariniidæ* whose diet comprises for the most part of nectar. The edges are only slightly curved in to form an open trough or gutter. In *Zosterops palpebrosa* it terminates in bristles for about ⅓ its length, divided into two 'brushes' (Fig. 2) while in *Dicæum erythrorhynchum*, the tip presents bifurcated half-tubes. In the Thick-billed Flower-pecker (*Piprisoma agile*), the tongue is triangular and broad at the base, short and cartilaginous except at the bifid tip. The curled edges are almost, if not entirely, absent and this together with the stout finch-like bill makes its possessor comparatively a casual visitor to flowers. In both these families the tongue, as in the *Nectariniidæ*, is extensile.

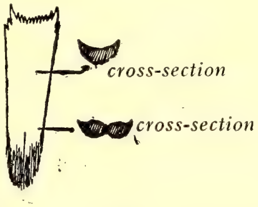


FIG. 2. Tongue of *Z. palpebrosa* (Nat. size about 12 mm. long.)

Besides these specialized families, it will be seen from my list of bird-frequented flowers that there are a great many heterogeneous species which, without being specially equipped, are nevertheless regular nectar-seekers. In order to show at a glance the birds observed as habitués of flowers, I append a separate list at the end giving the Orders, Families and Species of such. The lists are the result of observations relating to the past three years during which I have been able to pay somewhat more than passing attention to the subject of Ornithophily, especially in Western India and the Bombay Deccan. The records are principally based on direct observations in the field through powerful glasses and although they furnish good circumstantial evidence, it is clear that in a few instances only (where the microscope has revealed pollen adhering to bill or surrounding feathers—indicated by asterisks in the following lists) are they of a sufficiently experimental nature to be considered more or less conclusive in their application.

LIST OF FLOWERS OBSERVED TO BE REGULARLY FREQUENTED BY BIRDS.

Order : **MALVALES**

Family : MALVACEÆ

1. **Bombax malabaricum**, DC. (Coloured Plate, *J. B. N. H. S.*, xxxiii 632).

Flowers crimson, large and numerous, growing in clusters on short thick stalks towards the ends of the branches. They appear before the new leaves, and the bareness of the tree at this period provides excellent opportunities for the observation of bird-visitors.

Petals fleshy, bent back, 3-6″ long. Stamens pink, flattened, more than 60, united only at base to form five bundles, each containing 9-12. There is an additional inner bundle of 15 stamens of which the 5 innermost are longest. The conical ovary tapers at the apex to form a club-shaped style which exceeds the stamens in length and ends in 5 slender processes, the stigmas. The anthers are long and brown.

Flowering Season: January to March.

Distribution : Indigenous throughout India and Burma except in the most arid tracts. Sub-Himalayas upto 3,500′ (cultivated at 6,000 in N.-W. Himalayas) very common throughout the Bombay Presidency, Satpuras and all forest districts of Madras Presidency. Also Ceylon, Yunan, Cochin-China, Tonkin, Java, Sumatra, Queensland and North Australia.

Visitors : The flowers are visited by all the species of birds mentioned under *Erythrina indica* with the exception of [1] 18, 21, 39 and 46 which have not come under my notice so far. In this part of the country, the commonest visitors seen are Nos. 1*, 2*, 10*, 11*, 14*, 22*, 25*, 26*, 27*, 29*, 41*, 42, 43 and 44. I would, without hesitation, assign the pride of place to No. 25, *Pastor roseus* L. In an area where both *Erythrina indica* and this species are flowering, practically side by side, it has invariably been my experience that the Cotton Tree is by far the more patronized by this bird, while the Babbler (*Turdoides somervillei*) exercises his preference in favour of the Coral.

While the Bombax is in flower, the diet of the Rosy Pastor in many parts of the country seems to consist more or less exclusively of the nectar, a thick sticky sugary juice in the 'cup' at the base of the filaments. It comes to the trees imbued with a sense of ownership and launches the offensive against every other visitor to the blossoms, often rushing 15 or 20 feet across from the other side of the tree where it is feeding, to do so. Most small birds fly before the fury of its onslaught, often being driven from branch to branch. Even the indomitable King Crow has to give way. Alone in the Mynas *Acridotheres tristis* and *Æthiopsar fuscus* does the Pastor find its match. They, of all the feathered company, pay scant heed to its demonstrations. It is common to see a Pastor angrily drooping its wings and spreading its tail (flicking it sideways) perched in a truculent manner shivering with rage and swearing its heart out within a few inches of a completely unperturbed Myna busy on the flowers. At times the chivvying gets beyond the Myna's power of endurance whereupon it goes for the Pastor causing it to depart precipitately. After it has had its fill of the nectar, the Pastor will sometimes occupy itself solely with playing 'Dog in the Manger.' It sits on a branch and utters its bellicose *chit, chit, chit* varied by occasional attempts at a screeching song. When thus engaged, it usually takes shelter from the sun by getting into the shade of some branch. From this vantage point it continually launches sallies against Sunbirds and Striped Squirrels feeding from neighbouring flowers, twitching its wings threateningly. The nectar seems to act as a laxative and the bird excretes once in every three minutes or so. It feeds from the flowers all day long, but especially in the mornings before 11 o'clock. After a spell of assaults, angry chattering and 'song,' there are invariably little

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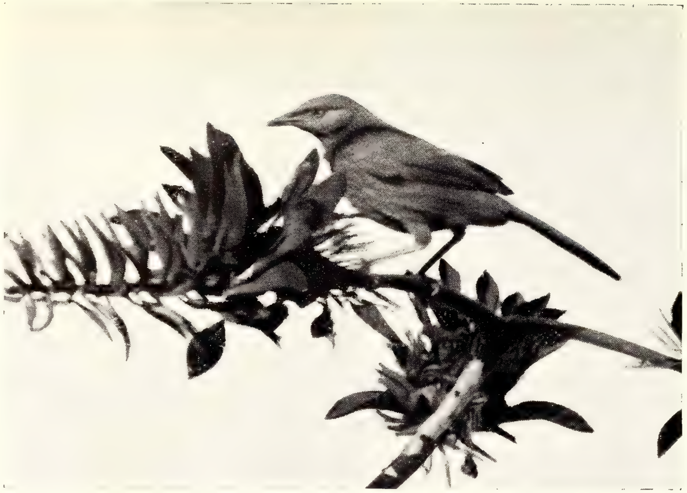
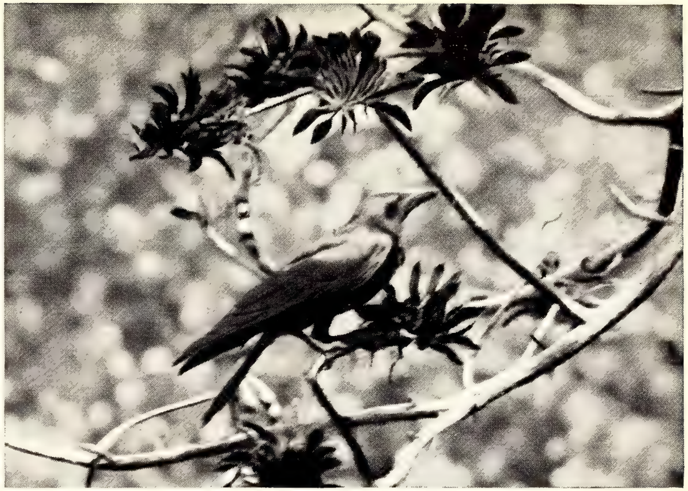
[1] Numerals refer to list of birds under *Erythrina indica.*

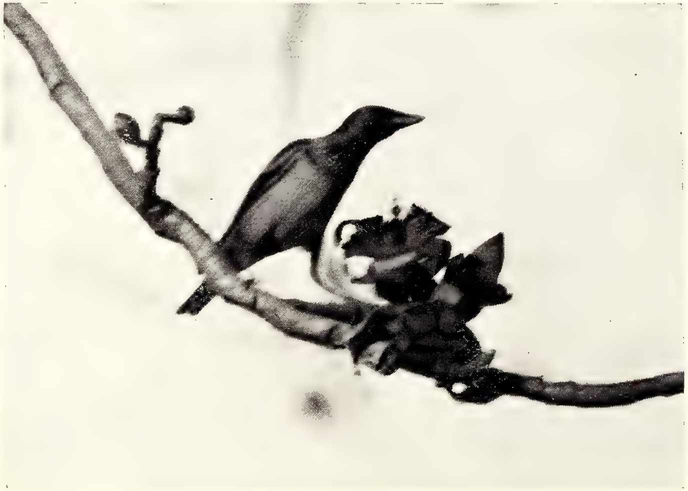


1.



2.

(1) **Bombay Babbler** (*Turdoides somervillei*) **and** (2) **Jungle Crow** (*Corus levaillanti*) **on** *Erythrina indica.*



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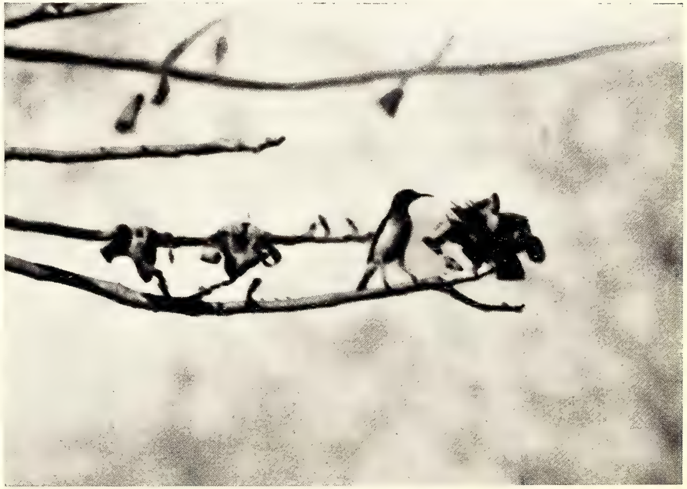


4.

(3) **Rosy Pastor** (*Pastor roseus*) **and Purple-rumped Sunbird** (*Leptocoma zeylonica*) **on** *Bombax malabaricum.*

(*Photos by Author*).

pauses of silence when all the company suddenly becomes dumb and motionless. The arrival of some new visitor soon puts an end to the truce however, and chasing and chattering are resumed once more. Sunbirds appear to act as 'honey guides,' for as soon as one is driven off a flower, the Pastor is sure to probe into the corolla itself. For a photographer who has focussed his camera on a suitable low-hanging bunch of flowers for a Pastor, there is nothing more promising than the visit of a Sunbird. In nine cases out of ten the Sunbird will promptly be replaced by the irate Pastor!

In a grove of Bombax trees in bloom near Kāmat Village (Alibag Taluka), there were two examples with flowers of a lemon-yellow colour. It struck me as particularly strange at the time, that although there was continuous hustling and rivalry among the birds on the normally coloured flowers, those of the yellow variety remained practically unattended, save for an occasional Sunbird that had been hunted off the crimson flowers. That the yellow flowers also contained nectar was evident on examination, but what the precise factor was that made them distasteful to the visitors I was unable to ascertain. My impression further is that in due course (as a consequence ?) when the pods made their appearance, a smaller number was noticeable on these two trees than on their normal neighbours, though I have no statistical evidence. I consider this point most interesting and worthy of a proper investigation. The yellow variety of *Bombax malabaricum* is certainly not common, and it would be interesting to know if this is merely a temporary aberration brought about by some physiological defect in the tree.

In addition to birds I have regularly found the Striped Squirrels (*Funambulus tristriatus* and *F. pennanti*) on the flowers licking the nectar and biting the petals. Troup observed *Ratufa gigantea* eating the flower-buds in quantities, and even Martens (*Martes flavigula*) visiting the flowers in search of nectar. It is probable that these mammalian visitors also contribute towards the cross-pollination of Bombax flowers.

[It is surprising that Knuth (*7*) mentions nothing regarding the pollination of this species, although, as Porsch (*14*, Part I) points out, Swinhoe recorded the visits of *Cinnyris rhizophoræ* Sh. to these flowers in the island of Hainan long ago.]

2. **Bombax insigne,** Wall.

Flowers larger than in the preceding species, somewhat paler red in colour. Often scarlet or white. Stamens 400–600 arranged in bundles, not so distinctly as in *malabaricum*. Style longer than stamens, terminating in 5-lobed stigma.

Flowering Season : January to March. In the Kolaba district this year 1931, I noticed the flowers early in January, before *malabaricum* had commenced to blossom.

Distribution : Burma, Pegu, Andamans. Common in Western Ghats from the Konkan southwards ; also Deccan and Anamalai Hills.

Visitors : Almost all the species of birds recorded under *malabaricum*. Also Striped Squirrels.

3. **Hibiscus Rosa-sinensis** L.

Flowers: Large bright scarlet or crimson, 4–5″ across, with a projecting red column of stamens and pistil.

Flowering Season: Throughout the year.
Distribution: Said to be a native of China and Northern India (?) and to have been in cultivation throughout Malaysia and Polynesia before Europeans came east. Cultivated in gardens throughout India.

Visitors: The conspicuous flowers, dazzling in the sunlight are beloved of the Sunbirds who visit them regularly. The commonest visitors in the Kolaba District (N. Konkan) are *Leptocoma asiatica* and *L. zeylonica* and sometimes also *L. lotenia.* At Panchgani (4,400 ft.) in the Western Ghats, I have commonly observed *Leptocoma minima* on the flowers, while at Mahableshwar (4,500 ft.) in more afforested country, *Æthopyga s. vigorsi* is a constant visitor.

In my experience, to get at the nectar all these species bore tiny holes with their bills at the base of the corolla, just above the calyx. Such 'short-cuts' have been described by Tiwary (*19*, *20*) in the case of *Sesbania grandiflora* and *Tecoma radicans* and by Porsch (*12*) in the case of many flowers in Buitenzorg Gardens, Java, including a Hibiscus of which he unfortunately does not mention the species. According to Lewis Bonhote the Sugar Bird (*Cœreba bahamensis* Rchb.), also bores holes in the calyx of Hibiscus flowers in the Bahamas to get at the honey. This habit obviously does not help to promote cross-pollination, and I cannot conceive of these birds functioning as important pollinating agents as has often been asserted by various writers. I have, however, occasionally seen *L. asiatica* and *L. zeylonica* hovering in front of an open flower to get at small insects within, and it is *possible* that in so doing, some pollen may accidentally adhere to the feathers and be transported to the stigma of another flower. If such a thing does occur, it can, in my opinion, only be exceptional. The plant has never been known to set seed in India (save for one isolated record which does not say whether the seeds were fertile), and Prof. N. K. Tiwary of the Benares University who has investigated its life history, informs me that this is due to some defect in its gametes.

Neger (*9*) in a list of species whose ornithophilous adaptations are 'beyond dispute' includes *Hibiscus Rosa-sinensis.* Werth (*21*) found the beautiful red flowers of this plant in Zanzibar to be visited by the Sunbird (*Cinnyris gutturalis*) and considers it to be ornithophilous, while Porsch (*14*, pt. i, p. 221) states that the genus *Hibiscus* contains in its large-flowered species quite a series of highly organized bird-flowers.

In view of the fact that all these authors take it for granted, more or less, that the flowers of *H. Rosa-sinensis* are fertilized by birds, it is presumable that in the countries to which they refer they have ascertained the plant to produce fertile seed. This however is a point on which confirmation is desirable.

Besides, though the flowers may occasionally be pollinated by hovering sunbirds in the manner I have above described, if *H. Rosa-sinensis* was indeed such a highly adapted bird-flower as Neger believes it to be, we should certainly expect a diminution in the size of the petals or lobes which at present constitute a broad alighting place for insects but are at the same time a distinct hindrance to birds in legitimate access to the nectar.

The need of further observation and investigation is indicated before we can accept the ornithophilous nature of the flowers of this plant. In India certainly all the evidence is, if anything, opposed to such a presumption.

4. **Thespesia populnea,** Corr. (Coloured plate, *J.B.N.H.S.*, xxxiv, 274).

Evergreen tree 30–50 ft. high with heart-shaped pointed leaves resembling those of the Peepal (*Ficus religiosa*). Flowers single or in pairs, 3–4″ across. Pale lemon-yellow with deep maroon centre. Finely crinkled petals set in cup-like calyx. The long style grows through a tube decked with a cluster of golden-headed stamens. It is crowned with a club formed of 5 close-set stigmas.

Flowering Season : Throughout the year, particularly at the beginning of the cold season.

Distribution : ‘ Tropical shores of Bengal, Ceylon and both Peninsulas. Tropical Asia, the Pacific Islands and Africa ’ (Hooker). Along the beach and tidal forests from Konkan southwards. Coasts of Chittagong and Andamans.

Visitors : I have regularly observed *Leptocoma asiatica* and *L. zeylonica* taking short-cuts to the nectar by boring with their bills at the base of the yellow crepe-paper-like corolla, just above the calyx. The birds frequently hover in front of an open flower for attending insects (or pollen ?) and *may* occasionally assist in transporting ripe pollen in the manner referred to under the preceding species, as the structure of the flowers and the position of the essential organs is very similar in both. This plant produces seed freely, but to what extent birds are responsible for the fertilization of its flowers, needs to be investigated.

Family : STERCULIACEÆ

5. **Sterculia colorata,** Roxb. (Coloured plate, *J.B.N.H.S.*, xxxv, 525).

A large tree, trunk erect, bark ashy, branches spreading. Flowers in numerous short terminal panicles, tubular, orange- or reddish-brown in colour. Calyx $\frac{3}{4}$″, tube 4 times longer than the rounded rather obtuse lobes, downy outside, pilose within. Style recurved ; the stigma over-tops the stamens and protrudes beyond the lobes. (Plate IV, 2).

Flowering Season : March to May. Tree leafless when in flower.

Distribution : ‘ Eastern Bengal, Pegu, the Western Peninsula and Ceylon ’ (Hooker).

Visitors : On March 28, this year (1931) my attention was drawn by Mr. C. McCann to a bare tree in flower near Bhandup (Salsette). I observed a Sunbird (*Leptocoma zeylonica*) hopping about from one cluster to another, probing into the tubular flowers with its bill. While we watched, a *L. asiatica* also arrived on a neighbouring tree and started off on the same quest. An examination of the flowers, about 1″ long and hanging in clusters from the ends of the bare branchlets, showed that the 'rim' is considerably reduced, and much clear nectar is present within, at the base of the corolla tube. From the position of the essential organs it is evident that the flowers are well adapted for pollination by the *Nectariniidæ* and the *Dicæidæ*, and there seems little doubt that these families play a considerable part in this vital process. Since then I have had several opportunities of confirming my observations, and have also followed through glasses a Flower-pecker (*D. erythrorhynchum*) eating nectar from these flowers.

Order: **GERANIALES**

Family: Burseraceæ

6. **Garuga pinnata,** Roxb.

A tree 30 to 40 feet. Flowers ·25″ long, yellow, in large pubescent compound spreading panicles.

Flowering Season: February to May (Talbot).
Distribution: 'Throughout India, and from the Jumna eastwards to Burma and southwards to the Nilgiris and Tenasserim; ascending to 3,000 feet in the Himalayas. Malayan Archipelago, Philippines' (Hooker).

Visitors: I have observed *Zosterops palpebrosa* and *Leptocoma asiatica* on the flowers, and on one occasion (near the Tulsi Lake in Salsette, March 3, 1929) a party of Rose-finches (*Carpodacus erythrinus roseatus*) were seen feeding from them. A male shot from this flock had pollen adhering to his forehead and upper breast, and nectar dripped freely from the bill when the bird was held up by its legs. It is very probable that besides the species noted, many others also visit the flowers which are rich in honey production. It also seems very likely that the birds assist in cross-pollination.

Order: **SAPINDALES**

Family: Moringaceæ

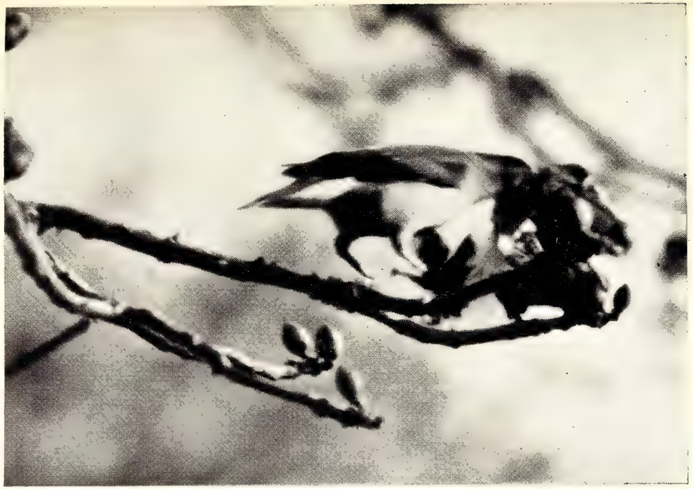
7. **Moringa oleifera,** Lamk. The Horse-radish or Drumstick.

A small tree, bark corky, wood soft, root pungent. Flowers in dense masses, creamy-white reminiscent of orange blossoms. Pedicelled, 1″ in diameter, honey-scented.

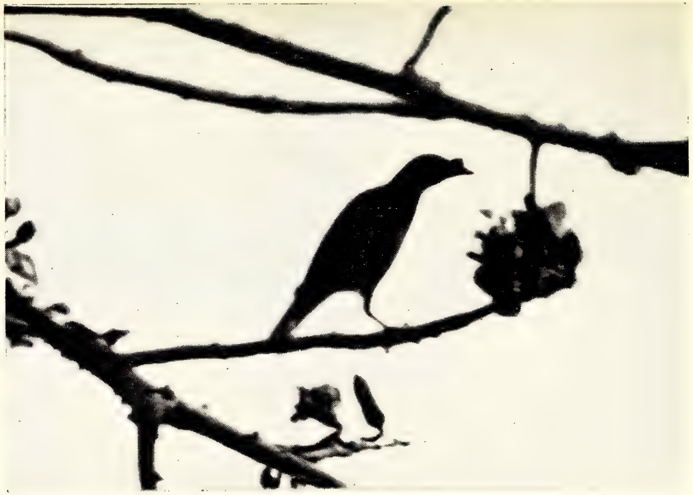
Flowering Season: Various. In Konkan principally November-December Hyderabad (Deccan) noted in March-April.
Distribution: Said to be a native of the forests of Western Himalayas and Oudh. Cultivated elsewhere throughout India and in various tropical countries.

Visitors: Wherever a tree is in flower—in a garden, some old village site or within the precincts of a populated village or hamlet, or even in the busiest and most crowded part of Bombay City such as Bhuleshwar or Pydhownie—it is invariably attended by the Sunbirds *Leptocoma asiatica* and *zeylonica*. In areas where other species of this family are common, the flowers are doubtless visited by them also.

Leptocoma asiatica and *L. zeylonica* may be seen on the flowers at all hours of the day, commencing almost at dawn though commoner and more noisy after the sun is well up—hopping from cluster to

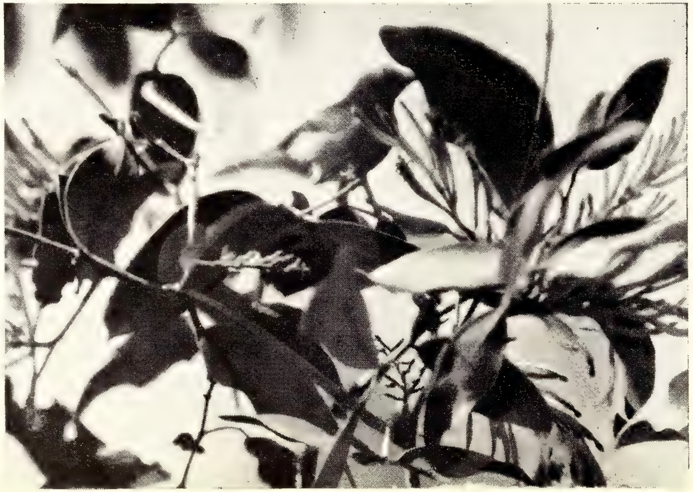


1.



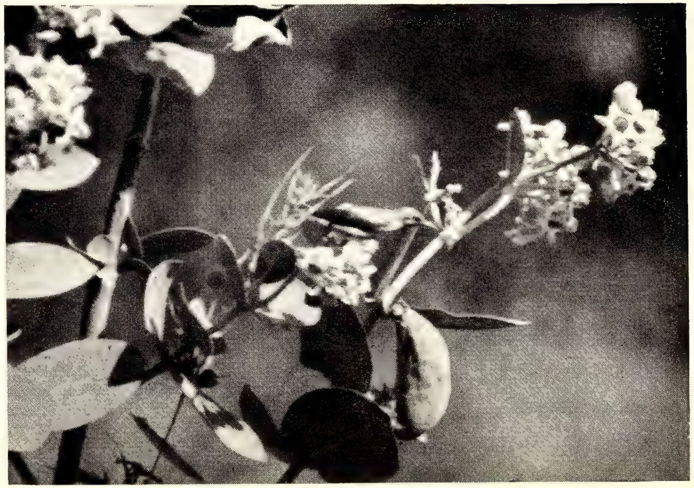
2.

(1) **Common Myna** (*Acridotheres tristis*) **and (2) Jungle Myna** (*Æthiopsar fuscus*) **on** *Bombax malabaricum.*



3.

Leptocoma zeylonica **on** *Loranthus longiflorus.*



4.

Leptocoma asiatica **on** *Calotropis procera.*

(*Photos by Author*).

cluster or darting from one tree to the next, hanging upside down and clinging to the branchlets in all manner of acrobatic positions in order to get at the nectar. There is much singing and display of vivacity, and frequent mock-battles ensue between the individuals of different pairs or species as one tries to oust the other from a specially coveted flower cluster.

Besides the Sunbirds, the flowers in the Konkan are largely attended by the butterflies *Aristolochiæ aristolochiæ* (black and red) and *Delias eucharis* (yellow and red) the former being by far the commoner. These are generally absent in the early mornings, but largely in evidence in the warmer parts of the day, especially on trees exposed to the sunlight. The *Aristolochiæ* butterfly often makes a feint at a Sunbird to dislodge him from a coveted flower-bunch and puts him to flight, itself presently returning to reap the fruits of its victory !

Another insect visitor frequently seen on the Drumstick blossoms is the humble-bee, *Xylocopa* (*amethystina ?*) which doubtless also assists in the cross-pollination of the flowers.

Although the structure and other characteristics of the Moringa flowers do not conform to the truly ornithophilous type, I think there can be no doubt that Sunbirds play a considerable part in their pollination in India.

Knuth mentions that the flowers have a great attraction for Humming and Sugar-birds[1] in the regions where both bird and plant occur together.

In the Bahamas the Sugar-Bird *Cœreba bahamensis* Rchb. is said to be in constant attendance on the blossoms of a large, all-year flowering species of Moringa.

Order : **ROSALES**

Family : LEGUMINOSÆ

' In this family ' according to H. Müller (*8*, p. 220) ' the essential organs are freely exposed. The petals or the stamens, or both together, attract insects '.

In India eight indigenous species of the genus *Erythrina* have been observed, all with red flowers. Two more have been introduced, viz., *E. Crista-galli*, L. and *E. Blakei*, Hort.

8. **Erythrina indica**, Lamk. (Coloured plate *J. B. N. H. S.*, vol. xxxiii, p. 624).

Prickly tree with spreading branches. Leafless when in flower. Flowers large, brilliant scarlet, arranged in racemes at tips of the branches. Corolla composed of five petals : an erect oblong standard which narrows at the base into a claw, two small wing-petals and two almost similar-sized keel petals of a distinctly darker hue. The wing petals partially enclose the keel. The stamens protrude for almost their entire length ; they are united into a bundle at the base. Higher up the tenth stamen is distinct and free. The margins of the carina (keel) tightly overlap, and together with the closely-fitted standard form a conical sac at the basal region which is full of nectar secreted by the glands situated at the base of the gynœcium. The exudation of nectar is profuse; I have obtained seven drops and more from a single sac, and as the same flowers are visited by successive visitors, it is evident that the supply is quickly replenished.

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[1] The Sugar-Birds (*Cœrebidæ*) contain about 75 species divided into 11 genera, and are amongst the most important pollinators of bird-flowers in Tropical Central and South America and neighbouring islands.

Flowering Season : February to May. In the Konkan by the middle of April most trees have finished flowering.

Distribution : 'Reported to be indigenous inland in deciduous forests of Thana, the Konkan, N. Kanara and Malabar, and from the Sunderbans along the coast through Arakan, Pegu, Tenasserim, the Andamans, Nicobars, Java, Polynesia' (Blatter).

Visitors : One of the most familiar and gorgeous features of the Indian countryside when in flower, the Erythrina becomes the rendezvous of almost every species of arboreal birds of the surrounding locality. Its branches rock and sway as the eager nectar-bibbers hop from one flower-cluster to another throughout the livelong day, and great noise and bustle prevails. Birds appear most busy between sunrise and about 11-30. There is usually a break from this hour to about 3 p.m.—during the hottest part of the day, after which the company gradually re-assembles. I have observed the following species eating nectar from the flowers. Those marked with an asterisk have been shot and ascertained by means of a tube microscope to be carrying pollen on the feathers of their forehead and/or throat.

1. _Corvus macrorynchos_*—Regular frequenter on the countryside.
2. _Corvus splendens_ *— do. also within town limits.
3. _Dendrocitta rufa_—Occasional.
4. _Turdoides terricolor_—Only once seen, but species uncommon in areas to which my observations have been confined.
5. _Turdoides somervillei_*—Perhaps the most common visitor. Invariably present.
6. _Chrysomma sinensis_*—Frequent.
7. _Dumetia albigulare_*—Not uncommon where tree is in suitable locality.
8. _Chloropsis jerdoni_* } —Both these are regular
9. ,, _aurifrons davidsoni_* } attendants but not common. They are very jealous of other visitors, constantly attacking and driving them off the flowers.
10. _Molpastes cafer_*—Regular and very common.
11. _Elathea jocosa_*—Regular and very common.
12. _Ægithina tiphia_—Only once definitely seen eating nectar. Probably visits flowers more in search of attendant insects.
13. _Pycnonotus luteolus_*—Common.
14. _Merula nigropileus_*—Regular, but seems to perfer Bombax.
15. _Copsychus saularis_*—Males singing from nearby trees frequently visit the flowers at intervals to have a sip of the nectar.
16. _Dicrurus macrocercus_*—Very common. Invariably present on flowers singly or in pairs. Jealous and bellicose, attacking and driving away other visitors from its proximity.
17. _Leucocirca pectoralis_—Not seen probing into flowers. Probably attracted by attendant flies.
18. _Tchitrea paradisi_—Seen only once. Probably in quest of flies.

19. *Muscicapula tickelliæ* }
20. *Hypothymis azurea* } —Frequently seen on the flower-laden branches, but not probing for nectar. Like the other Flycatchers, insects are probably their objective, and their importance as pollen-carriers can only be negligible, if at all.
21. *Lanius schach erythronotus*—Not uncommon, but only once seen probing into a flower. Probably after insects, or using leafless tree as observation post.
22. *Orthotomus sutorius**—Common.
23. *Prinia socialis*— do.
24. *Prinia inornata*— do.
25. *Pastor roseus**—Frequent visitor, but far more partial to Bombax flowers. Very impatient of rival feasters, often attacking and driving them away.
26. *Acridotheres tristis**—Very common and regular. Arrives in parties of 5 or 6, the individuals hopping methodically from one flower-cluster to another, raising their beaks to swallow the nectar.
27. *Æthiopsar fuscus**—Very common and regular where occurring. A remarkable feature about this species is the tuft of feathers at the base of the bill which functions as an efficient pollen-brush.
28. *Temenuchus pagodarum**—Invariable visitor where occurring.
29. *Sturnia malabarica**— Do. do.
30. *Oriolus xanthornus*—Frequent, but not common.
31. ,, *oriolus kundoo*— do.
32. *Ploceus philippinus**—Commonly feeding on the nectar in parties of from 5 to 30. Also present on the trees when the flowers are in final stages of withering. To all appearances they also feed on the tender newly-formed pods.
33. *Passer domesticus*—Where the tree is situated within town limits or in or near a village, the flowers are commonly visited by this species.
34. *Gymnoris xanthocollis*—Frequent.
35. *Uroloncha malabarica* }
36. ,, *striata* } —Occasional.
37. *Carpodacus erythrinus roseatus**—Not uncommon.
38. *Psittacula krameri**—Very regular in some localities. Its habit of plucking off the flowers before reaching the honey, probably minimizes its usefulness as a pollinating agent.
39. *Eudynamis scolopaceus*—Only twice seen eating the nectar, when it was very shy. May be a more frequent visitor in out-of-the-way situations.
40. *Loriculus vernalis*—Occasionally seen in particular localities.
41. *Leptocoma zeylonica**—Invariably present throughout the day.
42. ,, *asiatica*— do. do. do.
43. ,, *lotenia**—Very common in some localities.
44. *Æthopyga siparaja vigorsi*—Frequent in localities where it occurs.
45. *Zosterops palpebrosa*—Not uncommon. Flocks work the flowers thoroughly.
46. *Brachypternus aurantius*—I was greatly surprised when I first saw this woodpecker eating the nectar, (24-4-31) but since then I

have observed it several times. I assured myself by means of field-glasses that its quest was actually nectar.

[According Hermann Müller the large flowers of *Carolinea* are pollinated by woodpeckers. He remarks that 'these birds may seek in the flowers for insects as well as the honey, but certainly for the latter, since when they peck oranges, as is frequently the case, they can of course expect only sweet juice and not insects' (Knuth, vol. i, p. 77.)]

In addition to the birds mentioned, I have found everywhere that the Striped Squirrels (*Funambulus tristriatus* and *F. pennanti* or *palmarum*?) are amongst the most regular frequenters of the Coral tree in bloom. They move about from one flower-cluster to another, biting into and sucking the nectar sacs. This quest often brings them into clash with a number of the more determined avian competitors such as the Drongo and the Rosy Pastor. At times they hold their own, while at others are forced to beat a hasty retreat, tail in air! Of several specimens shot, three examples showed pollen sticking to the fur of the head and lower neck, from which it is evident that they must also assist in cross-pollination to some extent.

Porsch suggests that perhaps bats may also be responsible for similar service to the Coral tree, but careful watching of several trees on a number of occasions (at Kihim) till 10 p.m. failed to produce any evidence in support of this. It is of course possible that further observation in other localities may show his surmise to be correct.

9. **Erythrina stricta**, Roxb.

Flowers orange-scarlet in racemes at tips of branches, shorter than in *E. indica*. Structure very similar to that in preceding species.

Flowering Season: January to May. In Salsette and the Konkan the flowers appear somewhat later than in *E. indica*; the tree is leafless upto the time of flowering.

Distribution: 'Assam, Manipur extending westward to Nepal, Chittagong, Burma, Orissa; deciduous mixed forests of N. Kanara and the Konkan.' (Blatter.)

Visitors: The majority of species mentioned under *E. indica* doubtless visit these flowers likewise, as the trees grow in more or less the same type of country and often side by side. Among those noted by me in passing were Nos. 1, 5, 8, 10, 11, 14*, 16, 22, 26, 41, 42, 43.[1] A *Merula nigropileus* shot off the flowers at Tulsi Lake (Salsette) had the forehead and upper breast clotted with nectar to which much pollen was adhering. There was also a quantity of loose dry pollen on the feathers.

10. **Erythrina Crista-galli**, Linn.

According to Delpino (*8*, p. 215), the crimson flower 'is inverted, the alæ are almost entirely aborted, and the carina forms a sheath covering the column and expanded below into a large honey receptacle. Since the stigma somewhat overtops the anthers, the visitors, probably humming-birds, touch first the stigma and then the anthers and so effect cross-fertilization.' In other words, the flowers closely resemble those of the two preceding species in their structure.

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[1] Numerals refer to list of birds under *E. indica*.

Flowering Season : In Bombay, March-April.

Distribution : This plant is a native of Brazil whence it has been introduced into gardens in this country.

Visitors : On a specimen in bloom in the Victoria Gardens, Bombay, I have observed the two common species of Sunbird, *Leptocoma asiatica* and *L. zeylonica* as frequent visitors, and Mr. D. S. Laud, the Superintendent of the Gardens, informs me that he has also often observed them on the flowers.

As regards seeding, Mr. Laud informs me that this year (March-April 1931) although the tree flowered moderately, he was able to secure only twelve seeds. Ten of these germinated and by 25th June, the plants were about 18″ high. I consider it worthy of investigation why these flowers which appear in every way adapted for fertilization by Sunbirds (and other species) should produce such a scanty crop of seed. It will be seen from my notes further on, that there are many other apparently well-adapted exotic bird-flowers which inspite of the visits to them of suitable flower-birds, fail to produce seed in this country.

Werth points out that the flowers of *E. Crista-galli* can hardly be described as not exclusively ornithophilous just because humble-bees also occasionally help to pollinate them. Their colour and structure do not correspond with other humble-bee flowers, whereas they closely agree with ornithophilous forms.

In the Buitenzorg Gardens, Java, Porsch (*12*) observed *Cinnyris pectoralis*, *Æthopyga siparaja*, *Buchanga longa* Bp. =(*Dicrurus macrocercus* V.) and *B. cinerea* on the flowers of *Erythrina lithosperma*, Blume, which is largely cultivated in Java and grows wild in the mountains of Eastern Java. *lithosperma* of Blume is a synonym for *E. subumbrans*, Merr. an indigenous Indian species found in Burma in moist valleys near streams up to 3,000 feet. Also in Indo-China and Malaya. It flowers in January and February, the racemes of red flowers appearing with the leaves.

11. **Butea frondosa,** König. (Coloured Plate, *J.B.N.H.S.*, vol. xxxiii, p. 853).

An erect tree reaching 40–50 feet. Flowers grouped in threes along a velvety, dark olive-green stalk. In great profusion in stiff racemes about 6″ long. Petals flaming orange with tinge of salmon pink produced by covering of silky white down. Corolla 1·5″–2″. 5 petals ; the standard about 1″ broad, two smaller wing petals and a much curved, beak-shaped keel formed by the fusion of two petals. Stamens practically enclosed within the keel. There are ten, of which nine are united and one free. The curved style overtops the anthers and is suitably placed for fertilization by birds.

When in flower, the tree is either entirely leafless or has some leaves on the lower branches. The flowers chiefly cover the upper portions.

Flowering Season : End of January to March. In dry seasons the flowers appear somewhat earlier.

Distribution : 'Common throughout the greater part of India and Burma ; in the Himalayas upto 3,000 feet, in South India upto 4,000 feet. Rare or absent in arid regions. Often gregarious.' (Blatter.)

Visitors: The flowers, which contain a large quantity of nectar, are invariably attended by birds, and the rocking and swaying of the branches as the visitors hop from one flower-cluster to another, gives away their presence from afar. The following species have been observed by me, though very probably a great many others visit the flowers besides.

*Corvus macrorhynchos**—Regular and common.
,, *splendens**— Do. do.
Turdoides somervillei— Do. do.
*Acridotheres tristis**— Do. do.
Æthiopsar fuscus— Do. do.
Sturnia malabarica— Do. do.
Leptocoma asiatica— Do. do.
,, *zeylonica*— Do. do.

[A related species, *Butea superba*, Roxb., a gigantic woody creeper with a stem as thick as a man's leg, found in Central and South India and Burma, will probably also be found to be ornithophilous. So far, unfortunately, I have not had an opportunity of investigating this species, but the structure of its gorgeous orange-scarlet flowers which crowd the leafless branches between March and April, strongly suggests the probability. They are considerably larger than those of *Butea frondosa*.]

12. **Poinciana regia,** Bojer. (Coloured Plate, *J.B.N.H.S.*, vol. xxxiii, p. 851).

Large deciduous tree 40–50 feet with spreading branches and very handsome feathery leaves. Brilliant scarlet blossoms arranged in immense racemes at the ends of the branches. Each flower is composed of five petals of which four are scarlet while the fifth, the standard petal, is slightly larger in size and much variegated with yellow, white and red. They emerge from between five fleshy scarlet-faced sepals which form the calyx. The ten long stamens surround a slender green style which overtops them. The flowers measure about 4″ across.

As Werth has pointed out, the flowers show adaptations for entomophily as well as for ornithophily, and are visited by both birds and insects.

Flowering Season: The hot weather; April–June.
Distribution: A native of Madagascar introduced into this country within the last 100 years (Blatter). Common in gardens and as a roadside tree in Western India.

Visitors: The birds I have definitely observed probing into the flowers for nectar are:
Leptocoma asiatica
,, *zeylonica*
[H. Winkler observed both this and the next species, *Poinciana pulcherrima*, to be visited by Sunbirds in the Kameroons, Ledien in the Congo, and Knuth in Buitenzorg, Java.]

13. **Poinciana (Cæsalpina) pulcherrima,** Linn.

A shrub or small tree. Flowers orange-scarlet or yellow, much smaller than in *regia* and with very long and protruding stamens.

Flowering Season : In my experience, in the Konkan the tree is in flower throughout the year, though more abundantly during the latter part of the monsoon and the cold season.

Distribution : Universally cultivated through India, and elsewhere in the tropics ; the native country is not clearly known. (Hooker.)

Visitors : The flowers are largely visited by Sunbirds. *Leptocoma asiatica* and *L. zeylonica* may be almost invariably seen on them at all hours of the day. The nectar appears to form an important item of their dietary and in our garden at Kihim (last season), I observed that a female *L. zeylonica* sitting on her eggs about 30 yards distant from a Peacock-flower tree in bloom, usually made straight for the flowers when a break in the monsoon showers induced her to leave the nest for food. She was followed closely by her mate, and the pair would hop about from flower to flower clinging to the branches in every conceivable position and probing into the blossoms with their bills. On these occasions the cock was particularly lively and attentive to the hen, and between sips was constantly bursting into little snatches of song to the accompaniment of nervous flickings of his wings, as if to hearten her in her desultory task of incubation. The scene became particularly delightful to watch if the sun happened to peep out of the clouds and beam upon the dripping foliage and the resplendent plumage of the male.

The Rose-ringed Parrakeet (*Psittacula krameri*) is also a frequent visitor to the flowers, but as it destroys them by biting through (and also eats the pods), its services in pollination are doubtful. Owing to the length of the protruding stamens and the position of the style, it is however possible that those of surrounding flowers may come in contact with its plumage while it is busy biting one, and thus effect a limited amount of cross-pollination.

The flowers are also visited by *Xylocopa* and various other insects, and like *P. regia* they show adaptations both for bird and insect fertilization.

Genus : **BAUHINIA.**

According to Hooker, this genus contains 37 Indian species occurring in India including Burma, Malaya and Ceylon, with flowers white, yellow, and variegated red and yellow. In the open blossom, as in all papilionaceous flowers, the vexillum is erect and acts as a sign-board for visitors—insects as well as birds. The style is usually recurved at the tip and projects somewhat beyond the anthers, making the flowers suitable for cross-pollination by bird-visitors.

14. **Bauhinia purpurea,** Linn.

Flowers sweet-scented, deep pink—sometimes white—in terminal or axillary short-peduncled, few-flowered corymbs. Petals 1·5″ long × ·5″ broad; oblanceolate, with a long claw. Fertile stamens 3-4 ; filaments as long as the petals.

Flowering Season : September-November (Talbot).

Distribution : Sub-Himalayan tract from the river Ravi eastwards, ascending to 5,000 ft., Bengal, Burma, Central and Southern India. Cultivated throughout the Presidency, also probably wild in the dry forests of the Deccan and Konkan.

Visitors: The regular bird visitors observed by me, probing into flowers for honey, are the Sunbirds *Leptocoma asiatica* and *L. zeylonica.*

15. **Bauhinia racemosa,** Lam.

A small crooked bushy tree with drooping branches and bilobed leaves. Flowers whitish-yellow, ·5″ long in lax racemes 3–6″. Their structure is well-adapted for fertilization by birds.

Flowering Season : March-June (Talbot).
Distribution : Throughout the Bombay Presidency. From Punjab and Garhwal to Ceylon and Pegu. Also China, Malay Isles and Timor.

Visitors : Our two common species of Sunbird, *L. asiatica* and *L. zeylonica* have been observed by me as regular visitors to the flowers.

[Altogether the genus Bauhinia contains about 250 species distributed over the tropics of both hemispheres. Three species occur in Australia and F. J. Bernay mentions in a letter to G. M. Mathews that *Psitteuteles versicolor* Bonap., one of the Trichoglossidæ, feeds chiefly on the honey of Bauhinia flowers in Richmond (N. Queensland). In the case of two American species, Lindman has recorded visits to the flowers by Humming-Birds. (*14*, pt. ii, p. 190.)]

16. **Acacia arabica,** Willd.

Prickly tree with spiny branches and feathery leaves. Flowers bright yellow in globose fasciculate heads, about ·5″ in diam. Stamens free, indefinite, exserted. Style filiform; stigma minute.

Flowering Season : Rains, from June to October.
Distribution : Indigenous in N. Deccan including Berar and Khandesh; Rajputana, Gujerat and Sind. Several varieties.

Visitors : Among the birds regularly observed on the flowers are the Sunbirds, *Leptocoma asiatica* and *L. zeylonica*, and the Flowerpecker *Dicæum erythrorhynchum.* Also occasionally *Ægithina tiphia*, but the latter probably in search of insects. In Sind, the race *brevirostris* of *L. asiatica* is a regular frequenter of the flowers.

17. **Sesbania grandiflora,** Pers.

A short-lived, softwood tree, 20–30 ft. high. Corolla 3–4″ deep white (or in *Æschynomene coccinea* L. more or less deeply tinged with red). The structure of the flowers as in many of the Papilionatæ is well adapted for pollination by birds, and I have no doubt that to a large extent they are ornithophilous.

Flowering Season : November to February.
Distribution : 'Plains of the western peninsula (i.e. India proper); a doubtful native. Mauritius to N. Australia, but often cultivated' (Hooker).

Visitors : I have observed the following species of birds feeding from the flowers in the neighbourhood of Bombay and in the Konkan:

Corvus splendens
Molpastes cafer
Elathea jocosa
Leptocoma asiatica
,, *zeylonica*
Acridotheres tristis
Psittacula krameri (Destroys flowers; value doubtful)

With the Sunbirds, I have repeatedly found that they bore tiny holes with their bills at the base of the corolla to get at the nectar, and the large number of flowers both on the ground and from the tree that were examined, almost invariably showed these 'short-cut' punctures. N. K. Tiwary has pointed out (*19*) that the Red-vented Bulbul, Rose-ringed Parrakeet and the Myna also take these short-cuts to the nectar.

(The genus *Sesbania* Pers. contains about 24 species spread everywhere through the tropics and subtropics. Hooker mentions 4 as occurring within Indian limits.)

18. **Mucuna pruriens**, DC. Hind. '*Kawaj.*'

An annual of wide-twining habit. Short-peduncled drooping racemes 6″ to 1′ long, bearing 6-30 flowers. Corolla dark purple, 1·5″ long; keel curved.

Flowering Season : October-November (Talbot).
Distribution : 'From Himalayas, in the plains, to Ceylon and Burma. Cosmopolitan in the tropics. Often cultivated' (Hooker).

Visitors: The Sunbirds *Leptocoma asiatica* and *L. zeylonica* regularly seen clinging upside down or sideways on to the flowers and probing into them with their bills. From the structure of the flowers, it appears very probable that these birds are instrumental in their cross-pollination and therefore in the propagation of this handsome-flowered, but pernicious, weed.

(Hooker gives 10 Indian species of the genus *Mucuna*, Adans. including perennials as well as annuals. They all have large showy, usually purple flowers which turn quite black when dry. The pods are covered with brittle needle-like irritating hairs.)

Order: MYRTALES

Family: LYTHRACEÆ

19. **Woodfordia fruticosa**, Kurz. Mahr. '*Dhaiti.*'

A shrub with long spreading branches, brilliantly red with flowers in the hot season. Flowers scarlet, tubular, about 1″ long. The 'rim' (or lobes) is greatly reduced, offering no alighting place for insects. The flowers contain a good supply of colourless and odourless honey, and the essential organs are favourably placed for pollination by Sunbirds and Flowerpeckers.

Flowering Season : Hot weather, March to May.

Distribution : 'Throughout India, common ; ascending to 5,000 ft. but not seen in the alluvial mud of Bengal, Baluchistan, Tropical Africa, Madagascar, China' (Hooker) ; also Japan, Sumatra and Java. In the Bombay Presidency, the plant is common on the Deccan hills and in the Konkan, Bombay, Poona, Khandesh, N. Kanara near the sea coast.

Visitors : I have noted the following species of birds probing into the flower-tubes for the nectar :

Leptocoma asiatica } Regular in the Kolaba District.
,, *zeylonica* }
Leptocoma minima—(Partabgad Hill).
Æthopyga siparaja vigorsi—Frequently at Godbunder (Salsette).
Dicæum erythrorhynchum—Frequently on the hillsides at Salao (Kolaba Dist).

For their visits the birds appear to prefer the morning hours upto about 11-30 A.M. when the sun is shining brightly upon the flower-laden shrubs. I have seen them, but less frequently in the afternoons also.

[Ball has recorded constant attendance on these flowers by *L. asiatica* in Chota Nagpur. (*6*, vol. ii, p. 397).]

Family : COMBRETACEÆ

20. **Calycopteris floribunda**, Lamk.

A dense and diffuse shrub with drooping branches, 6-12 feet high, often gregarious. Flowers sessile, yellowish-green in dense axillary racemes, crowded towards the ends of the branches so as to form large panicles. The small flowers—each with a lanceolate bract—are very like those of *Terminalia* and scarcely larger ; they enlarge later into winged fruit. They are almost entirely devoid of smell and contain a quantity of clear honey. (Plate IV, 4).

Flowering Season : March-April.
Distribution : On hot hills 500-2,500 feet ; abundant throughout the Deccan, and from Assam to Singapore.

Visitors : The following species have been commonly and regularly observed probing into the flowers, and doubtless assist in their cross-pollination :

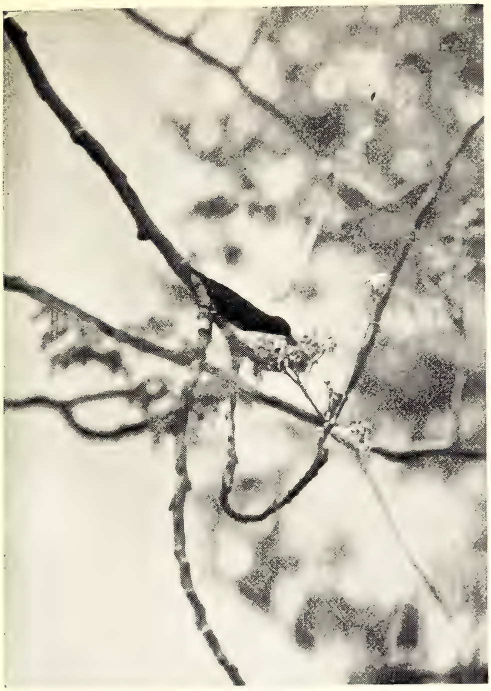
Leptocoma asiatica
Leptocoma zeylonica
Prinia inornata

Family : MYRTACEÆ

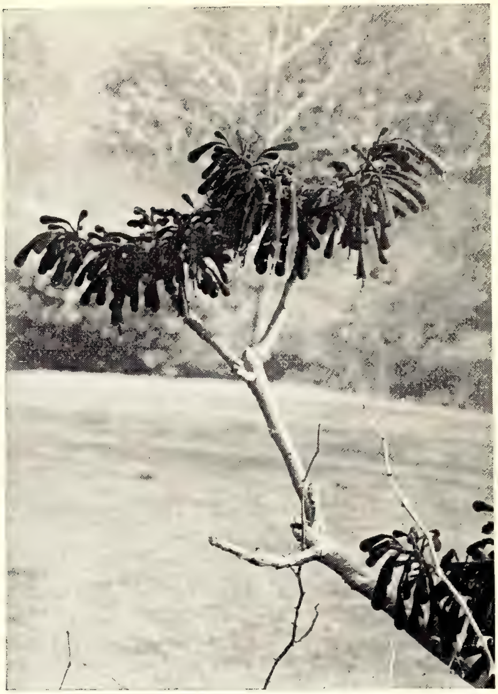
21. **Careya arborea**, Roxb.

A tree attaining 30-60 feet. Flowers sessile, large white and pink, a few together crowded at ends of branches. They are of the ornithophilous type named by Werth the 'Brush Type.' (Plate IV, 3).

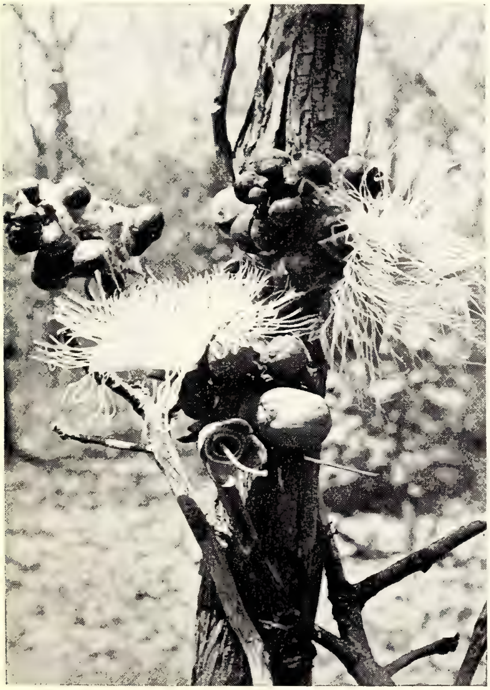
Flowering Season : March-April.
Distribution : Throughout India upto 4,000 feet : from the Himalayas to Travancore and Tennaserim. In Ceylon at moderate elevations.



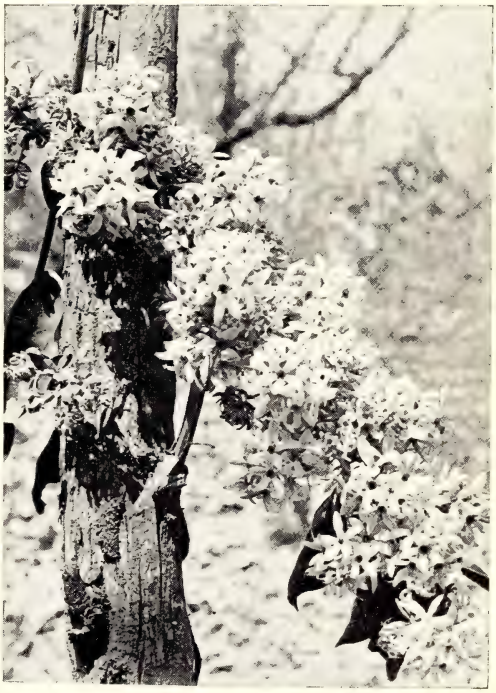
1. *Leptocoma asiatica* **on** *Moringa oleifera.*



2. **Flowers of** *Sterculia colorata.*



3. **Flowers of** *Careya arborea.*



4. **Flowers of** *Calycopteris floribunda.*

(*Photo* 1 *by Author,* 2, 3, 4 *by C. McCann*).

Visitors: The following birds have been observed feeding regularly from the flowers :

Acridotheres tristis
Æthiopsar fuscus
Pastor roseus
Leptocoma asiatica
,, *zeylonica.*

[This tree belongs to a family which is large and well-represented in the Tropics. It contains many genera and species which are well known to be bird-pollinated. Among the species occurring in India and recorded as ornithophilous by Werth may be mentioned *Jambosa vulgaris* DC. (*Eugenia jambos*, Linn.) which, according to Brandis is indigenous in Sikkim and Terai, and *Barringtonia racemosa* (L.) common along the coasts in Konkan and elsewhere.

Among the best-known ornithophilous plants of this family however are the Eucalypti, of which numerous species have been introduced into this country. One of these, *Eucalyptus globulus*, Lab., which now flourishes on the Nilgiris has been recorded as being visited by Sunbirds in South Africa (Marloth) and by Humming-Birds in Chile (Johow), and although I have no definite information, there seems no reason why birds should not act as pollinators in the areas where it has become acclimatized in India also. According to Swynnerton (*Jour. Linn. Soc.*, London, Bot. 1906, p. 409) a *Pycnonotus* also visits the flowers of *Eucalyptus ficifolia* introduced into South Rhodesia (Porsch).

It is believed that the flowers of most of the moderate and large-flowered species of this genus are more or less exclusively ornithophilous in the Australian Region which is their home.]

Order : **GENTIANALES**

Family : ASCLEPIADACEÆ

22. **Calotropis procera,** Br.

A shrub 6-15 feet high. Corolla pale purple, ½″–2″ in diam., of a wax-like structure, flowers in umbellate, axillary or terminal cymes. Corolla-tube broadly campanulate ; lobes ¾ the corolla.

Flowering Season : Throughout the year.

Distribution : 'Western and Central India ascending to 3,500 ft. from Sind and the Punjab to Bihar and Bombay. Ava, Persia, Tropical Africa.' (Hooker.) I have also seen it at Panchgani in the Western Ghats (4,400 ft.) near the top of Second Table-land.

Visitors : I have observed the Sunbirds, *Leptocoma asiatica* and *L. zeylonica* on the curious waxen purple flowers so regularly, and in so many different parts of the country (Sind, Hyderabad Deccan, the neighbourhood of Poona, Cambay (Gujerat), Bombay City and Salsette, and at various places in the Konkan) probing into the blossoms, that I cannot but consider it reasonable to suppose that they must often carry the pollinia adhering to the feathers of the forehead or throat to other flowers and promote cross-pollination.

As far as my observations go, the visits to the flowers are chiefly confined to the early morning or forenoon hours when the sun is shining directly upon the plant. I have often noted that a particular plant has its own particular individual visitor (or visitors), and that this forms as it were his preserve from which other comers are jealously excluded. Thus at Panwel (Kolaba Dist.), a plant growing close to the Inspection Bungalow was the possession of a male *Leptocoma asiatica* in non-breeding attire whom I could recognize with certainty by certain peculiarities in his plumage. During the three or four days I occupied the bungalow, he alone visited the flowers of this Calotropis regularly, especially during the hours I have indicated above. While feeding, this Sunbird utters a double 'tweet-tweet' at intervals of a second or so, by which I was immediately apprised, in whatever part of the bungalow I happened to be, that my friend was on the flowers, and sure enough on every such occasion he was there! One morning on the bank of the river at Panwel, I found eight individuals of this species on a single Calotropis plant which was blossoming abundantly (30–1–31). They were hopping about merrily from flower to flower probing into them with their bills, and often clinging to the branches upside down in the quest. The plant grew in a thoroughly exposed situation, as is its habit, and when the birds were on it, it was exposed to the full blaze of the sun (10 o'clock).

In Sind, I have often found *L. asiatica brevirostris* on Calotropis flowers, at great distances in sandy wastes where there seemed little else to attract the birds.

Among insects *Xylocopa* is a regular attendant on the flowers. (*C. gigantea*, Br. will also no doubt be found to be visited by Sunbirds.)

Order **PERSONALES.**

Family : SCROPHULARIACEÆ.

23. **Russelia juncea**, Zucc.

A tender shrubby plant with smooth, somewhat rush-like leaves, noddy or pendulous at the top. The dazzling scarlet tubular flowers, about 1″ in length, have the rims or lobes greatly reduced, are odourless and rich in nectar, and in all these respects appear eminently adapted for fertilization by Sunbirds.

Flowering Season: Practically throughout the year. (Kihim, October-November Panchgani, May-June!)

Distribution: A native of Mexico and Central America. A common ornamental garden plant everywhere in India.

Visitors: The flowers are a great attraction to Sunbirds, which visit them regularly in every garden. In Bombay City and North Konkan (Kolaba District) *Leptocoma asiatica* and *L. zeylonica* have been noted as the commonest visitors, and in Panchgani I have seen *L. minima* in addition to these.

Porsch quotes Motley (Shelley 'Monograph of the Nectariniidæ') who also constantly observed 3 or 4 *Cinnyris pectoralis* Bp. on a plant of this species outside his office window, hanging in all possible positions on the branches and probing into the scarlet tubular flowers.

In spite of these seemingly suitable bird-visits, the plant has to be propagated in this country entirely by layering and cuttings as for some obscure reason it never produces seed. This is one of the many examples of introduced species which in spite of all apparent facilities for cross-pollination fail to produce seed in the country of their introduction.

Family : BIGNONIACEÆ.

24. **Millingtonia hortensis,** Linn. (Coloured Plate *J.B.N.H.S.*, vol. xxxiv, p. 85).

An erect tree upto 80 ft. high, lanceolate in outline, with drooping branches. The fragrant flowers grow in large panicles at the ends of the branchlets. Tiny bell-shaped calyx bears the slender tube-like flowers, 2″–3″ long × $\frac{1}{16}$ ″, white with a faint green tinge. The tube expands into the waxy white petals, sometimes flushed with pink. The four petals are oval, pointed at the apex and the largest of them is deeply cleft. Four stamens crowned with yellow anthers. The style protrudes well beyond the anthers.

Flowering Season : In Bombay, the Konkan, Hyderabad (Deccan) flowering commences in October and continues till December. In other parts of India, August-September.

Distribution : Believed to be indigenous in the tropical forests of Burma, from Ava to Tenasserim and the Malay Peninsula. Cultivated in many parts of India, and runs wild in many areas such as the Godaveri Valley, Central India. Frequently planted along roadsides.

Visitors : The principal bird-visitors to the flowers noted in Konkan, Bombay and Hyderabad are the Sunbirds *Leptocoma asiatica* and *L. zeylonica* which cling to the branchlets and probe methodically into the corolla-tubes for the nectar.

In the evergreen forests of Tenasserim (on the hills surrounding the Mining Company's dam at Kanbauk), I also observed a great many Sunbirds probing into the flower-tubes. Owing to the height of the trees and absence of binoculars, I was unfortunately unable to determine the species.

Curiously enough, the tree does not produce fruit in Western India or the Central Provinces.

(Since this paper went to press, I have had better opportunities of observing the activities of the Sunbirds *Leptocoma asiatica* and *L. zeylonica* on the flowers of this tree. I find that while it is true that the birds occasionally probe into the tubes in the manner conducive to cross-pollination, by far the more usual method adopted by them is to get at the honey by boring short-cut holes with their bills at the base of the corolla-tube just above the calyx.)

25. **Spathodea campanulata,** Beauv. (Coloured Plate *J.B.N.H.S.*, vol. xxxiv, p. 716.)

Handsome, erect evergreen trees (except in the drier areas where leaves are shed for a few weeks) growing to 70 feet, with large pinnate leaves and very showy scarlet, bell-shaped flowers, mostly near the top. From its curving boat-shaped calyx, the flower emerges as a short tube which abruptly expands into a wide bell some 4″ long. Lobes of flower oval and wavy-margined. Flower, orange at base deepening into brilliant crimson further up. Inside rich yellow, streaked with red. Four yellow exserted stamens tipped with pendant brown anthers. The nectary glands exude a profusion of nectar.

Flowering Season : In Bombay chiefly January-March, but also in the rains. In Ceylon throughout the wet season.

Distribution : A native of tropical Africa. Introduced into Ceylon in 1873. Grown in gardens in India and planted as a roadside tree along many of Bombay's thoroughfares, Lamington Road, Chowpati and elsewhere.

Visitors : The conspicuous large scarlet flowers attract many species of birds who may be seen probing into the ' bells ' to get at the abundant nectar at all hours of the day, but specially from the early morning uptil 11–30 or so. Within City limits the birds usually seen ' on duty ' are *Corvus splendens*, *Acridotheres tristis* and the Sunbirds *Leptocoma zeylonica* and *L. asiatica*. On a magnificent specimen flowering in the garden of Khan Bahadur Bhivandiwalla at Uran (Kolaba Dist.) in January, I watched a company of birds feeding from these flowers through binoculars for a considerable time. In addition to the species already mentioned, there were in this assemblage *Corvus macrorhynchus*, *Æthiopsar fuscus*, *Molpastes cafer* and *Elathea jocosa.*

Through what agency the flowers are pollinated in their native country I do not know, but it is clear that in India birds play an important part in their fertilization.

My doubts as to whether this tree produced fertile seed in India were dispelled by Mr. D. S. Laud, the Superintendent of the Victoria Gardens, Bombay, who informs me that the roadside trees in Bombay seed freely. These seeds are used for the propagation of plants on sale at the Gardens and show a high percentage of germination. At the Empress Gardens, Poona, also they collect their own Spathodea seeds for propagation purposes. In the face of this it is interesting to learn from the Curator, Government Botanical Gardens, Ootacamund, that this tree produces only a very few fertile seeds at Burliar—at an elevation of 2,500 feet in the Nilgiris—probably not more than 1 per cent.

[In the Buitenzorg Gardens in Java, Porsch (*12*) observed *Sturnopastor jalla* Horsf. and *Pycnonotus aurigaster* Vieill. quenching their thirst from the nectar of *Spathodea campanulata* flowers.]

Family : ACANTHACEÆ.

26. **Adhatoda vasica,** Nees.

Usually a dense shrub, 4–8 ft. high, sometimes arborescent and reaching to 20 feet. Flowers white in dense axillary, peduncled spikes near the ends of the branches. Corolla 1·25″ long ; tube ·5″ long, lower part cylindrical, inflated above. Filaments long, curved.

Flowering Season : Kolaba District, January.

Distribution : ' India from the Punjab and Assam to Ceylon and Singapore, common, frequently cultivated. Malaya and S.-E. Asia ' (Hooker). A common hedge-plant throughout the Bombay Presidency from Gujerat to North Kanara.

Visitors : I first observed the Sunbird *Leptocoma zeylonica* on some shrubs forming a roadside hedge in a village near Mahad (Kolaba District). Numbers of these birds were in constant attendance on the flowers. Subsequently in other parts of the district, both this species and *L. asiatica* were invariably seen feeding on nectar from the flowers. There is usually great rivalry between the two species, and even between individuals of the same species and many mock-battles and sorties ensue.

Order : **LAMIALES.**

Family : VERBENACEÆ.

27. **Gmelina arborea,** Linn.

An unarmed tree, sometimes attaining 60 ft., deciduous, flowering with young leaves. Corolla brown-yellow ; upper lip shortly bifid, longer than lower. The rim of the flower is greatly reduced, and the position of the essential organs seems well adapted for bird-pollination.

Flowering Season : March—April.
Distribution : 'Throughout the Deccan Peninsula and Ceylon, frequently extending to the foot of the N.-W. Himalayas, Chittagong, Malayan and Philippine Islands' (Hooker).

Visitors : On a tree flowering in the middle of March at Kihim (Kolaba District), the Sunbirds *Leptocoma asiatica* and *L. zeylonica* were constantly observed hopping from branch to branch, probing into the tubular nectar-bearing flowers throughout the day.

28. **Duranta Plumieri,** Jacq.

Familiar ornamental shrubs planted in gardens and as hedges. Bright heliotrope-coloured flowers in drooping bunches, succeeded by orange-coloured berries of the size of a pea.

Flowering Season : Chiefly during the rains, simultaneously with the appearance of the new leaves on the bare branches, or soon after.
Distribution : A native of South America. Found in gardens all over India and planted as roadside hedges.

Visitors : In the Kolaba District and in Bombay City and suburbs *Leptocoma asiatica* and *L. zeylonica* have been observed as constant visitors to the flowers, probing with their bills into the tubes for nectar. In Panchgani *Leptocoma minima* has been noted as a regular attendant besides. The corolla-tubes are short and the stamens and style not sufficiently exserted to permit of their coming into contact with the forehead feathers. *If* the birds are instrumental in cross-pollination, which I consider more than probable, the pollen must be transported adhering to their bills of which not more than $\frac{1}{3}$ can be inserted into the flower.

The pollen grains of Duranta under a microscope appear thus : Fig. 3.

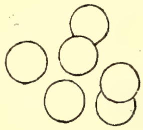


FIG. 3.

Besides the Sunbirds, a number of insects have been noted on the flowers, principally *Xylocopa* (*amethystina ?*) and bees (spp.?)

Order: **CURVEMBRYAE.**

Family NYCTAGINACEÆ.

29. **Bougainvillea spectabilis,** Willd.

A large, thorny, extensively climbing shrub. Flowers in profusion, small pale yellow supported by large purple or magenta-coloured bracts, in groups of three.

Flowering Season : Hot weather.
Distribution : A native of Brazil. Found in gardens all over India.

Visitors: The flowers are in regular and constant attendance by Sunbirds of which I have noted (according to locality), the following species carefully through glasses, probing with their bills deep into the flower-tubes and sipping the nectar:

Leptocoma asiatica
,, *zeylonica*
,, *minima*
Æthopyga siparaja vigorsi

Although the flowers appear in every way suitable for pollination by Sunbirds, this climber also fails to produce seeds in this country. What appears surprising is that *Bougainvillea laterita*, bearing brick-red bracts, which is sometimes considered only a variety of *spectabilis*, is reported by the Superintendent, Victoria Gardens, Bombay, to produce seed.

Order : **ACHLAMYDOSPOREAE.**

Family : LORANTHACEÆ.

(Tree Parasites.)

(The genus *Loranthus* contains, according to Hooker, altogether some 350 species exclusively tropical and sub-tropical. He gives 58 species as occurring within Indian limits, besides 13 doubtful and excluded. The flowers are classified by Werth (*21*) into the ornithophilous type which he names ' Explosive Flowers ,' and to which many of the African *Loranthi* also belong.)

30. **Loranthus longiflorus,** Desr. Var. **falcata.** Kurz.

Corolla tubular, 1″–2″ long, pink or yellowish-white.

Flowering Season : Throughout the year, most abundantly in the cold weather.
Distribution : Deccan Peninsula, Ceylon.

31. **Loranthus langeniferus,** Wight.

Corolla 1·5″ long, tube dilated upwards, red below, green above, anthers reddish ; style red.

Flowering Season : April, May, June. (Talbot) September (Kihim !).
Distribution : Hills of the Konkan.

32. **Loranthus loniceroides,** Linn.

Corolla 1–1·15″ long ; tube funnel-shaped, pink ; anthers orange.

Flowering Season : February to May (Talbot); June, July (Panchgani !).
Distribution : From the Konkan to Travancore, W. Ghats, Nilgiris, Ceylon,

33. **Loranthus scurrula,** L. var. **cordifolia,** Blatt.

Corolla greenish-yellow, about ·5″ long; filaments flattened, crimson.

Flowering Season : November-February (Talbot) ; June, July (Panchgani !)
Distribution : Common throughout India, Ceylon, Malaya. Variety found in the W. Ghats.

34. **Loranthus obtusatus,** Wall.

Corolla red outside, dark purple within.

Flowering Season : March to May and September.
Distribution : Konkan, W. Ghats, N. Kanara.

35. **Loranthus cuneatus,** Heyne.

Corolla tube slender, upto 1″ long : greenish yellow outside, orange within. Stigma red. Leaves small and ovate closely resembling those of *Osiris arborea*, in appearance.

Flowering Season : November-December (Talbot) ; June, July, August (Panchgani).
Distribution : W. Peninsula, Ceylon.

I have shown elsewhere [1] how admirably adapted the flowers of *Loranthus longiflorus*, Desr. are for fertilization by the *Nectariniidæ* and the *Dicæidæ*. Their structure is such that the mature buds wither and fall away without opening, unless and until external pressure is exerted on their tips by the bills of the visitors which alone can cause them to fling open. No insect can get at the nectar contained in the corolla-tubes until the buds are opened. The shape and size of the flower constitutes a perfect sheath for the bill of the Sunbird, and the style which overtops the stamens is so placed that it cannot but brush against the forehead of the probing visitor. In the act of nectar-eating, the anthers carrying the ripe pollen lie flat against the forehead feathers of the visiting bird thus smearing them with a liberal coating of the golden dust which is subsequently transferred to the protruding stigma of the next flower visited. All the *Loranthus* species above named possess the same spring or 'explosive' mechanism in their buds, and consequently the agency of the birds is indispensable for their pollination. Without their intervention, it is obvious that the parasites would soon die out completely.

I believe it is the conspicuous yellowish, reddish or coppery tinge of the *Loranthus* leaves which plays the role of poster-signs, making the clumps of the parasite stand out clearly from amidst the surrounding foliage of the host, and thus helping to attract the attention of foraging birds from a distance.

Visitors : The birds responsible for the fertilization of *Loranthus* flowers in the Konkan are :

Leptocoma asiatica *
,, *zeylonica* *
,, *lotenia* *
Dicæum erythrorhynchum *
Æthopyga siparaja vigorsi (in wooded country).

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[1] *J. B. N H. S.*, vol. xxxv, p. 145.

Elsewhere on the Ghats, Mahableshwar, Panchgani, etc., I have in addition noted *Leptocoma minima* as a very common and regular visitor to the flowers, and a White-eye (*Zosterops palpebrosa*) shot off a clump of *Loranthus scurrula* in the act of springing the buds open and probing for nectar, was found to have some of the characteristic winged pollen grains adhering to its forehead feathers.

The only bird outside the typical nectar-eating families observed on *Loranthus* flowers (*scurrula*) is *Molpastes cafer*, several pairs of which I have often watched through binoculars for prolonged periods, hopping from one cluster to another parasiting on a *Ficus retusa* at Panchgani, busily engaged in nipping the mature buds open and probing into the corolla tubes for nectar. The tube in the species named is slender but is slit down for more than half its length, thus enabling the somewhat heavy bill of the bulbul to reach the honey. On one or two of the birds there was clearly visible a whitish streak running from the base of the bill over the forehead towards the crown where the pollen was adhering. There was a Flowerpecker feeding on another *Loranthus scurrula* clump on the same tree, and I noticed that whenever he flitted across to the clump occupied by the bulbuls, the latter immediately assailed him and drove him off.

A very remarkable case frequently quoted to show the correlation between the geographical distribution of ornithophilous flowers and of their particular pollinating agents, and the complete interdependence between the two, is that of the Sunbird *Cinnyris osea* and *Loranthus acaciæ* Zucc. in Palestine. It is significant that the northern distributional boundary of the *Nectariniidæ* (extending from Senegambia to Kordofan, Nubia, Abyssinia, Palestine, Baluchistan, Nepal, Sikkim, Siam, Cochin-China and up to the Philippines) corresponds more or less exactly with the northern limits of the best known ornithophilous plants such as Musa, Loranthus, Hibiscus (?), Bombax, Erythrina, Kigelia and perhaps also Rhododendron. The only region in Asia above this line i.e. above 30° N.Lat., where a member of the *Nectariniidæ* occurs is Palestine. *Cinnyris osea*, the species in question, is found as far north as the Genazareth Sea and perhaps farther. Its principal distributional area however is in the neighbourhood of the Dead Sea, where strangely enough is also found, transgressing its usual bounds, a species of Loranthus, *L. acaciæ*, Zucc. The distribution of this plant as given by G. E. Post (*Flora of Syria, Palestine and Sinai*, 1896), overlaps completely that of *Cinnyris osea* and shows the symbiotic relationship between the flower and the bird.

[According to Engler (Engler-Prantels Nat. Pflanzenfam. iii, 1, p. 184) *Loranthus acaciæ*, Zucc. is found in Nubia, Palestine and Abyssinia. It also occurs in Arabia (Hadramaut). Reichenow gives the distribution of *Cinnyris osea* (Die Vogel, Handb. d. system. Ornithologie, ii, 1914, p. 487) as Syria, Palestine and Arabia. Porsch (*14*, pt. i, p. 234) states that in Palestine it is the only Sunbird and ensures the pollination of the *Loranthus*. Hart (*4*) also remarks on the occurrence together of *Loranthus acaciæ* Zucc. and *Cinnyris osea* in the Sinai Peninsula, where the former parasites on tamarisk and Zizyphus. He procured specimens of this Sunbird and found their long bills covered with pollen of the tubular flowers for probing which they are well adapted, and surmises that the plant is dependent for the fertilization of its flowers on the visits of this species. Over other portions of the range of *Loranthus acaciæ* various other *Cinnyris* spp. also act as pollinators].

Clear-cut instances of this kind of symbiosis between Humming-birds and the bird-flowers they chiefly frequent are well known, and it has likewise been pointed out that the disappearance of the Honey-eaters *Anthornis melanura* and *Prosthemadera novæ-zealandiæ* in the Auckland Islands (south of New Zealand) at the southernmost extremity of tree-growth, would spell the speedy extinction of *Metrosideros lucida* and *Dracophyllum longifolium* whose flowers are dependent for their fertilization exclusively on these species.

I feel confident that intensive study of the subject in India will lead to much interesting knowledge concerning the connection between flower-birds and the geographical distribution of bird-flowers. *Loranthus* flowers with their bird-operated explosive mechanism and their undoubted ornithophilous character might well afford a suitable starting point for such an investigation.

Another interesting investigation which the subject of Ornithophily opens up, and on which little or no work has been so far done in India, is as regards the shape and structure of pollen grains. It is likely that a careful study may reveal special adaptations for ensuring the adherence of the pollen of highly organised ornithophilous flowers to the feathers of their bird-visitors. Thus, according to Stresemann (*17*, p. 451), the pollen grains of Phrygilanthus and other ornithophilous Loranthi in Santiago are equipped with tiny wing-like processes which make it easier for them to cling between the barbules of the bird-feather than it would be for round-shaped grains.

I have examined the pollen grains of *Loranthus longiflorus*, *L. scurrula* and *L. cuneatus* microscopically and find this peculiarity to hold good in the case of these Indian species also. A diagram of their structure is given here. (Fig. 4) In all three species they are identical in shape but in *cuneatus* they are about one-third larger than in the other two. The shape of the pollen grains has obviously a direct connection with the fact that all the three species are highly adapted bird-flowers. I found the pollen grains of *L. longiflorus* to be indistinguishable from those of *L. scurrula*.

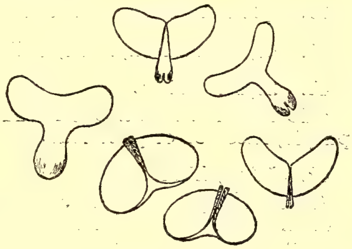

FIG. 4.

MONOCOTYLEDONES.

Order : **CALYCINÆ.**

Family : PALMÆ.

36. **Cocos nucifera**, Linn. The Coconut Palm.

Flowers unisexual, male and female on the same spadix.

Flowering Season : Practically throughout the year.

Distribution : 'Cultivated in the hot damp regions of India, Burma and Ceylon, especially near the sea ; (indigenous in the Cocos Islands and North Andamans, Kurz). All tropical shores' (Hooker).

Visitors : I have time and again observed both *Leptocoma asiatica* and *L. zeylonica* on the spadices of the flowers at most hours of the day. At Kihim in December, two or three birds of the latter species were watched on the same tree day after day early in the mornings, just before sunrise, when the dew was yet so heavy that it dripped from the leaves. That they were taking off the dew from the blossoms I have no doubt, but whether they were instrumental in transferring the pollen to the female flowers, it was not possible to ascertain. Hume, Davidson and so many other observers in India have repeatedly recorded these and other species of Sunbirds attending on the coconut inflorescence, and it would be interesting to discover the true significance of these visits.

Little is known about the pollination agencies of this palm, though insects are believed to operate, and Hermann Müller (7, p. 562) on the authority of Delpino also states that the flowers of *Cocos* are anemophilous.)

The following is a list of some of the more familiar genera and species of plants occurring in this country as indigenous or well-established exotic species whose flowers have been referred to as entirely, or in part, ornithophilous in the literature I have consulted on the subject.

37. **Ceiba pentandra,** Gaertn. (= *Eriodendron anfractuosum,* DC.)

38. **Bruguiera gymnorhiza,** Lamk.

(I have often casually seen *Dicæum erythrorhynchum* among the branches of this mangrove in the tidal swamp at Rewas (Kolaba Dist.) but not noticed it feeding from the flowers.)

39. **Quamoclit coccinea,** Moench (= *Ipomœa coccinea,* Linn.)

40. **Bryophyllum calycinum,** Salisb.

41. **Sophora,** Linn.

(Hooker mentions about 10 Indian species. Flowers showy yellow or violet-purple, racemed or panicled.)

42. **Salvia,** Linn.

(Many indigenous species, mostly Himalayan. I have frequently noticed Sunbirds on the scarlet flowers of *Salvia splendens,* a familiar introduced garden plant which has been recorded by W. Trelease (Amer. Natur. vol. xv, pp. 265–69, 1881. Bot. Centralbl. No. 50, 1881), as Humming-bird-fertilized.

43. **Lonicera,** Linn.

(Many species in India).

44. **Leonotis nepetæfolia,** Br.

45. **Lobelia,** Linn.

(Many indigenous species).

46. **Canna indica,** Linn.

(Sunbirds commonly seen on flowers).

47. **Musa.**

(Hooker gives three species: *paradisiaca,* Linn., *textilis,* Nee., and *sapientum,* Linn.)

48. **Amherstia nobilis,** Wall.

49. **Vitex pubescens,** Vahl.

50. **Lumnitzera coccinea,** Wgt. et Arnott.

51. **Sonneratia acida,** L. f.

52. **Gloriosa superba,** Linn.

53. **Grevillea robusta,** A. Cunn.

54. **Eucalyptus globulus,** Lab. and many others of this genus.

LIST OF BIRDS OBSERVED TO BE REGULAR FLOWER-FREQUENTERS[1]

Order : **Passeres**

Family : Corvidæ
1. *Corvus macrorhynchus* Lesson, 1*, 2, 8*, 9, 11*, 25.
2. ,, *splendens* Vieill, 1*, 2, 8*, 11*, 17, 25.
3. *Dendrocitta rufa* Latham, 1, 2, 8.
4. *Crypsirina temia* Daudin. (Observed by E. Henricks on red flowers of cotton tree in Henzada Dist., Burma, *Bombax malabaricum* ?)

Family : Timaliidæ
5. *Turdoides terricolor* Hodgs 8.
6. ,, *somervillei* Sykes, 1, 2, 8*, 9, 11.
7. *Xiphorhamphus superciliaris* Blyth. (Meinertzhagen, Ibis 1927, p. 575, notes that near Darjeeling, a pair used to visit a red cotton tree in bloom and studiously probe the flowers.)
8. *Dumetia albogularis* Blyth, 1, 2, 8*.
9. *Chrysomma sinensis* Gmelin, 1, 2, 8*.

Sub-Family : Leiothricinæ
10. *Ægithina tiphia* Linn., 8, 16.
11. *Chloropsis aurifrons* Temm. and Laug. 8*.
12. *Chloropsis jerdoni* Blyth, 8*, 9.

(As noted by Porsch, *Chloropsis* has a feathery tip to its tongue. The tongue is bifurcated at the tip into two sets of bristles which roll over each other to form a tube. The entire length of the organ, moreover, is concave on the upper side forming a channel. Observation and study is necessary to determine the significance of this.)

Family : Pycnonotidæ
13. *Microscelis psaroides ganeesa* Sykes (Noted by Betts, *J.B.N.H.S.*, vol. xxxiv, p. 1027, on Erythrina flowers).
14. *Molpastes cafer* Linn. 1*, 2, 8*, 9, 17, 25, 33.
15. *Elathea jocosa* Linn. 1*, 2, 8*, 9, 17, 25.
16. *Pycnonotus luteolus* Lesson, 1, 2, 8*.

Family : Turdidæ

Sub-family : Phœnicurinæ
17. *Copsychus saularis* Linn. 8*.

Sub-family : Turdinæ
18. *Turdus merula nigropileus* Lafresnaye 1*, 2, 8, 9*.

Family : Muscicapidæ
19. *Muscicapula tickelliæ* Blyth, 8.
20. *Tchitrea paradisi* Linn. 8.
21. *Hypothymis azurea* Boddaert, 8.
22. *Leucocirca pectoralis* Jerdon, 8.

Family : Laniidæ
23. *Lanius schach erythronotus* Vigors, 8

Family : Dicruridæ
24. *Dicrurus macrocercus* Vieillot, 1, 2, 8*, 9.
25. ,, *cœrulescens* Linn. 1, 2.

Family : Sylviidæ
26. *Orthotomus sutorius* Pennant, 1*, 2, 8*, 9.
27. *Prinia socialis* Sykes, 1. 2, 8.
28. , *inornata* Sykes, 8, 20.

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[1] Numbers after species refer to foregoing list of plants.

Family : ORIOLIDÆ
29. *Oriolus oriolus kundoo* Sykes, 1, 2, 8.
30. ,, *xanthornus* Linn. 1, 2, 8.
Family : STURNIDÆ
31. *Pastor roseus* Linn. 1*, 2, 8*, 21.
32. *Sturnia malabarica* Gmelin, 1*, 2, 8*, 11.
33. *Temenuchus pagodarum* Gmelin, 1, 2, 8*.
34. *Acridotheres tristis* Linn. 1*, 2, 8*, 9, 11*, 17, 21, 25.
35. *Æthiopsar fuscus* Wagler 1*, 2, 8*, 11, 21, 25.
Family : PLOCEIDÆ
36. *Ploceus philippinus* Linn. 1, 2, 8*.
37. *Uroloncha malabarica* Linn. 8.
38. ,, *striata* Linn, 8.
Family : FRINGILLIDÆ
Sub-family : FRINGILLINÆ
39. *Carpodacus erythrinus roseatus* Blyth, 6, 8*.
40. *Gymnoris xanthocollis* Burton, 1, 2 8.
41. *Passer domesticus* Linn. 1, 2, 8.
Family : ZOSTEROPIDÆ
42. *Zosterops palbebrosa* Temm. and Schlegel, 1, 2, 6, 8, 33*.
Family : NECTARINIIDÆ
Sub-family : NECTARINIINÆ
43. *Æthopyga siparaja vigorsi* Sykes, 1, 2, 3, 8, 19, 29.
44. *Leptocoma lotenia* Linn. 1, 2, 3, 8*, 9, 30*, 31.
45. ,, *asiatica* Latham, 1, 2, 3, 4, 5, 6, 7, 8*, 9, 10, 11, 12, 13, 14 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30* 31, 32, 33, 34, 35, 36, 42.
46. ,, *minima* Sykes, 3, 19, 23, 28, 29, 30, 31, 32, 33, 34, 35, 42.
47. ,, *zeylonica* Linn. 1*, 2, 3, 4, 5, 7, 8*, 9, 10, 11, 12, 13, 14, 15 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30*, 31, 32, 33, 34, 35, 36, 42.

(The above family is represented in India by 5 genera and 23 species with numerous sub-species. They are distributed in almost every part of India, Burma and Ceylon, and are the most important pollinators of flowers among the birds.)

Family : DICÆIDÆ
48. *Dicæum erythrorhynchum* Latham, 5, 16, 19, 30*, 31, 32, 33, 34, 35.
Order : **Coraciiformes**
Sub-Order : PICI
Family : PICIDÆ
49. *Brachypternus benghalensis* Linn. 8.
Sub-Order : CUCULI
Family : CUCULIDÆ
Sub-family : EUDYNAMINÆ
50. *Eudynamys scolopaceus* Linn. 8.
Sub-Order : PSITTACI
Family : PSITTACIDÆ
51. *Psittacula krameri* Scop, 1, 2, 8*, 13, 17.
52. *Coryllis vernalis* Sparrman, 8.

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MEASUREMENTS AND NOTES ON SOME LITTLE-KNOWN CEYLON MAMMALS.

Collected at West Haputale, Ohiya. (Altitude 6,000 feet.)

BY

A. C. TUTEIN-NOLTHENIUS, F.Z.S.

(*With 1 text-figure*).

The following notes have been made while collecting small mammals for Scientific purposes, in the country and jungles adjoining West Haputale estate.

The estate lies hidden in one of the deep valleys on the southern face of the mountain range, some 1,000 feet below the Horton Plains, and so far very little collecting of small mammals had been done.

The altitudes proper run from 4,000 feet to 6,000 feet and higher. The average rainfall is about 110 inches, October to December being the wettest months during the North-East monsoon. The S.-W. is dry and very windy.

The jungles surrounding the north and east sides of the estate are for the most part high and heavy virgin forest with its usual vegetation. Lower down the patnas border the estate, while in the ravines and along the boundaries much Paspalum grass is grown.

Nearly all trapping was done round and near the main bungalow, situated at an elevation of 6,000 feet. Coconut was mostly used as bait, while various shrews were trapped by using meat.

I have to thank Mr. W. W. A. Phillips, for having initiated me in this very interesting study, and for all the help and advice he has so freely given me, reading my notes and identifying specimen collected.

GENUS : RATTUS.

Rattus ohiensis. Phillips.

The Ceylon Bi-coloured Rat.

Collected and described by W. W. A. Phillips, F.Z.S., in the *Ceylon Journal of Science*, section B., vol. xv, part ii, p. 167.

Type.—An adult male, caught on December 1 1928, at West Haputale, Ohiya, in the province of Uva, Ceylon.

The type is in the British Museum.

Measurements of the type are—

Length of head and body	...	150	mm.
Length of the tail ...	...	187	,,
Hind foot ...	...	33	,,
Ear ...	...	22	,,

Description.—This very pretty animal is about the same size as the common house rat but it is more slender in shape and much finer looking. The face is long and pointed, the tail much longer than the head and body. Ears are large and naked.

Fur short, very soft, rather woolly on the underparts. Feet are covered with very fine fairly stiff hairs, small tufts of stiff hairs above the whitish claws. Whiskers are numerous and very long. Tail scaly and covered with minute hairs.

Colour.—Upper parts of the head and all over the back, darkish slate grey to black or blueish black. Underparts pure snow white, with a very sharp dividing line where the darker fur meets the white, starting on the lower jaw and running down to the root of the tail. The snout is light blue-grey and sometimes slightly pinkish. Whiskers black, intermixed with silvery ones.

Most noticeable is the coloration of the tail in all specimen. It is truly bi-coloured, the exact upper half over the entire length of the tail, being darkish dull black, the under half being pure white.

The type specimen showed only some pure white at the extreme tip of the tail, but since then several specimen have been collected with a pure white end to the tail, measuring from 25 to 30 mm. in length. I had an idea this might be a sign of age, but most of those specimen, examined by Phillips, proved to be adults.

Habits.—At the time Phillips collected the first single specimen, now known as the Type, it was thought that the species which had never been seen before in this neighbourhood, was uncommon, but later experience has proved that it is by no means rare round here, between elevations of 5,000 to 6,000 feet. Below 5,000 feet no specimen so far has been collected. Sometimes three or four were brought in on one day, all trapped with coconut, near or in the jungle surrounding the bungalow and gardens, a few were trapped between the tea bushes, while one (No. 50) was caught actually in the bungalow.

Sexual differences.—Appear to be very slight, but the female averages slightly smaller in size.

Identification.—This rat is very easily identified by the very noticeable, typically bi-coloured tail, and the pure white underparts.

Parasites.—A few minute red ticks and very rarely a flea.

Feeding.—Stomach contents so far have only shown vegetable matter.

Remarks.—Nothing as yet is known about its breeding habits ; several males in ' rut ' have been collected but none of the seven females appeared to be pregnant. All specimen given in my list were collected during May and July.

Phillips remarks that it would appear that this rat is allied to ***Rattus niviventer***, the White-bellied Rat of the Himalayas.

The species being new, I give a comple list of all the different measurements.

Measurements :

Coll. Number.	Head and body.	Tail.	Hind foot.	Ear.	Sex.
28	161	182	33	22	♂
29	146	180	34	23	♀
34	142	185	33	22	♂
37	146	170	31	20	♂
38	161	177	34	21	♂
41	166	173	30	21	♂
42	140	170	31	21	♂
44	142	166	32	19	♂
45	149	178	32	21	♂
47	167	193	34	21	♂
50	165	178	33	23	♀
57	125	148	28	19	♀
77	134	160	31	20	♂
82	167	196	35	22	♂
108	162	187	33	22	♂
109	149	170	33	21	♂
114	154	186	32	22	♂
116	140	185	34	21	♂
121	175	191	33	21	♂
122	164	190	35	22	♂
124	137	162	30	21	♀
125	140	173	30	20	♂
127	161	188	34	20	♂
129	163	192	32	22	♂
136	155	180	33	20	♂
137	140	168	31	20	♂
140	146	180	32	20	♂
141	141	172	31	19	♂

Coll. Number.	Head and body.	Tail.	Hind foot.	Ear.	Sex.
142	140	180	31	19	♂
143	143	184	32	20	♂
145	140	172	31	20	♂
146	138	162	30	19	♂
154	125	163	32	20	♂
159	141	189	32	20	♂
166	143	178	31	21	♀
167	155	185	31	20	♀
174	144	191	32	21	♂
178	180	191	32	23	♂
186	167	192	33	22	♂
187	148	173	32	22	♀
Average 33 males	150·39	179·87	32·24	20·72	
Average 7 females	145·57	170·00	31·28	21·28	

GENUS : RATTUS.

Rattus rattus kelaarti

The Ceylon Highland or Kelaart's Rat ; The Common Rat.

Rattus rattus kelaarti. Phillips. *Ceylon Journal of Science*, Sect. B., vol. xiv, part ii, p. 264.

I do not propose to describe in detail this common Ceylon up-country rat, so well known to, and so very much disliked by every one who has had to spend some time of his life in an up-country bungalow.

The damage this small, prolific rodent does, is well-known and truly amazing. I have known it gnawing wooden picture frames hanging against the wall, and silver mustard pots having been scratched by the sharp little teeth.

It seems to have a great liking for flowers left overnight in a room, specially carnations which it tears into tiny little bits and leaving them all over the place.

One particular old female here made it a habit to decorate her nest with small objects which it carried or dragged every night from the mantelpiece, going so far as to take away and use a box of gramophone needles, a ' mushroomed '' rifle bullet, and a small ivory tortoise.

Phillips gives the average measurements for 9 males, as—

length of head and body ...	157·5 mm.
length of tail	170·5 ,,
hind foot	31· ,,
ear	20· ,,

and the average measurements for 5 females, as—

length of head and body ...	149· mm.
length of tail	176·4 ,,
hind foot	30·4 ,,
ear	20· ,,

The average measurements of specimen collected here, are—

	head and body	tail	hind foot	ear
31 males ...	145·70	168·00	30·09	19·77
25 females ...	149·20	180·64	30·40	19·84

Parasites.—Several large fleas have been collected off these Kelaart's rats and will be examined and identified, as it is thought that some of these parasites are peculiar to up-country districts.

GENUS : CŒLOMYS.

Coelomys mayori. Thomas.

Mayor's Spiny Rat.

1915. *Cœlomys mayori.* Thomas. *Journal B. N. H. Society,* vol. xxiii, p. 416.

The genus is peculiar to Ceylon. W.W.A. Phillips, *Ceylon Journal of Science,* section B , vol. xiv, part 2, p. 275.

Type Locality.—Pattipola, Central Province, Ceylon. (Elevation 6,000 feet, about 10 miles from here. a.c.t-n.)

Specimen of this small jungle rat were collected for the first time by Major W. E. Mayor, in 1915, at Pattipola, Ohiya, and on the Horton Plains, elevations from 5,700 feet to 7,000 feet. It appears to be fairly common in the jungles round here.

Phillips gives the measurements of one male, as—

length of head and body	...	102 mm.
length of tail ...	...	100 ,,
hind foot ...	...	25 ,,
ear ...	...	12 ,,

My averages for 20 males, give a hindfoot measurement of 23·30 mm., and a fair measurement for identification is 23 mm. for the hindfoot, twenty-five out of thirty-two specimen measured show an exact 23 mm.

Identification.—The small size, half the size of a common Ceylon rat, the very rough, harsh and spiny fur (hence its name of Spiny rat), and the hindfoot measurement of 23 mm.

Fur.—Upper hairs or fur, distinctly rough and hard, numerous stiff and longer 'spines' interplanted, underfur very soft and short wool. Fur on underparts softer and short. Minute hairs on the feet. Tail scaly with minute hairs. Whiskers numerous and fairly long. Ears naked.

Colour.—General colour of upper-parts darkish, reddish brown to black, the spiny hairs sometimes silvery grey, more often quite black. The softer fur tipped reddish brown, giving a somewhat 'speckled' appearance to this little animal. Feet grey, tail dusky with slightly lighter coloured underside. Ears dusky to black. Underparts brownish grey.

There are said to be only two species of Coelomys in Ceylon, *Coelomys mayori,* and *Cœlomys bicolor,* as the name of the latter implies, of a distinct coloration, the underparts being pure white.

C. bicolor, so far has been found only up to an elevation of some 3,000 feet, while *C. mayori* is confined to the higher altitudes, but just lately a specimen was collected here with distinctly pure white underparts ; most unfortunately it (No. 54), could not be preserved.

In practically every specimen collected, the ears were covered with several, small or quite large, warts of a dirty greyish colour.

Habits.—This small rat seems to be fond of living in high, damp jungle, generally prowling about near the trunks or stumps of large or dead trees, or near and under boulders and rocks where the vegetation is rank and damp. All, so far, have been trapped with coconut, while stomach contents showed tiny seeds and vegetable matter.

Parasites.—Every specimen swarms with numerous minute red or grey ticks.

Sexual differences.—None noted, probably the female is slightly smaller in build. No outward signs of "rut" were noted in any of the males taken.

Measurements :

Coll. Number.	Head and body.	Tail.	Hind foot.	Ear.	Sex.	
2	90	92	23	17	♀	
3	80	90	23	18		♀
10	100	90	23	18	♀	
18	107	101	23	17		♀
19	85	85	23	15	♀	

Coll. Number.	Head and body.	Tail.	Hindfoot.	Ear.	Sex.
20	100	82	23	17	♂
22	93	94	23	16	♀
23	80	72	22	12	♀
35	102	101	22	17	♀
43	100	85	23	18	♂
46	88	93	23	17	♂
49	87	112	25	18	♂
53	96	100	23	17	♂
54	99	89	23	18	♀
55	110	100	23	19	♂
56	95	90	23	14	♂
60	101	99	23	16	♀
62	97	85	23	15	♂
63	105	99	24	17	♂
81	92	93	23	16	♂
94	103	104	24	16	♂
123	116	98	24	17	♂
126	105	88	23	18	♀
139	103	96	23	16	♂
152	101	100	23	14	♂
153	94	102	23	16	♀
160	96	100	23	14	♂
164	94	98	23	18	♂
165	88	102	23	16	♂
168	101	96	23	15	♂
169	98	91	24	16	♂
185	100	95	23	16	♂
Average 20 males,	98·50	96·65	23·30	16·20	
Average 12 females,	94·66	91·58	22·83	16·66	

GENUS: GOLUNDA.

Golunda ellioti newera. Kelaart.

The Nuwara Eliya Bush-Rat.

Golunda ellioti. The Indian Bush-Rat. Blanford, No. 299, p. 437.

Golunda ellitoti newera. The Nuwara Eliya bush rat. Phillips, Ceylon *Journal of Science,* section B., vol. xiv, part 2, p. 280.

Size.—Size of body about the same as a small Common Ceylon rat, but of a far heavier, more compact, square and clumsy build. Head short and rounded, not pointed or like the snout of a common rat. The tail very short, thick and stumpy, legs and feet short and small in comparison with the size of the body. Ears small and hairy. A very distinct type and form of animal, very different to the ordinary rat.

Fur.—Fine, fairly thick and long, intermixed with many long piles, specially over the centre of the back and towards hinderpart of body. Feet and ears are covered with short thick hairs; tail scaly, with many short stiff hairs. Whiskers short, very fine and not numerous.

The skin is very tender, easily torn and extra care must be taken when skinning and preserving these small mammals.

Specimens collected here, were all in very fine condition and showed layers of thick, white, and very greasy fat when being skinned. They have a fairly strong and quite peculiar smell, very different to any rat or mouse I have handled.

Colour.—Upper parts darkish brown, intermingled with reddish-yellow, finely speckled all over, which gives a very pretty appearance. The longer piles are coal black. Underfur is soft and of a dirty blue-grey colour. The underparts are a dirty grey, yellowish blue, and quite distinctive. Teeth are orange yellow.

Identification.—This bush rat is easily identified, (specially if once handled) by the very short, thick tail, the squat clumsy and heavy, soft body. Even when dead for some time, the body feels much softer to the hand than the fairly hard, stiff body of a common rat.

Remarks.—At one time this rat seems to have been fairly numerous, and was well-known to the older generation of planters as the 'Coffee rat', which did considerable damage to the young coffee plants, buds and blossoms of the coffee tree.

At the present time it does not seem common round here at all, while I much doubt if many of the present-day planters have ever come across or seen this one-time enemy and serious pest.

Personally I had never seen one here during the last thirteen years and was most interested when at last some specimen of this pretty little animal were collected, and duly identified for me by Phillips as the Nuwara Eliya bush-, or Coffee-rat.

The seven specimens taken here so far, were all trapped with coconut, one being caught by the garden cooly, all in very high and long Paspalum grass which borders the boundary of the high jungle near the gardens. The stomach contents make me believe that they too have a great liking for the cabbages in our vegetable garden.

They are said to often live in pairs, but I have been able to take only two males during the last two months.

Measurements :

Phillips gives the averages of 3 males, as—

length of head and body	... 135	mm.
length of tail	... 113	mm.
hind foot	... 27	mm.
ear	... 17·6	mm.

and the measurements for one female, as—

length of head and body	... 131	mm.
length of tail	... 100	mm.
hind foot	... 24	mm.
ear	... 18	mm.

Measurements of specimen collected here, are—

Coll. Number.	Head and body.	Tail.	Hind foot.	Ear.	Sex.
141	143	91	25	20	♀
149	140	90	27	20	♂
179	133	81	25	17	♀
182	125	89	26	16	♀
188	138	100	25	18	♀
202	136	97	26	18	♂
211	132	102	26	16	♀

Average 2 males, 138·50 93·50 26·50 19
Average 5 females 134·20 92·60 25·40 17·40

Parasites—a few very small red ticks.

GENUS : CROCIDURA.

Crocidura miya. sp. n. Phillips.

The Long-tailed Shrew.

Crocidura miya.—Phillips. *Ceylon Journal of Science*, Sect B., vol. xv, Part 2, p. 113.

On June 19, 1931, I was fortunate in taking two specimen of a very interesting shrew, which after careful study, I hoped and expected to be the new and rare species of the long-tailed Ceylon shrew, *Crocidura miya*, which later on was confirmed for me by Phillips to whom the two specimen, one mounted and one in alcohol, were sent for identification.

Phillips gives the Type locality, as Moolgama village, near Galaha, in the Central Province of Ceylon, altitude 3,000 feet.

Measurements of the Type, and adult female, are—

length of head and body	79 mm.
length of tail	88 mm.
hind foot	16 mm.
ear	8 mm.

Measurements of the two specimen collected here, are—

Coll. Number.	Head and body.	Tail.	Hind foot.	Ear.	Sex.
147	83	91	16	9	♀
148	81	94	16	9	♀

It is of interest to note, that the important hindfoot measurement in all three specimen known so far, all females, is exactly 16 mm. in every case.

Nos. 147 and 148, were taken the same night, in a small ravine, at an altitude of about 5,500 feet, in traps baited with coconut, and were at once recognised as quite distinct to other mountain shrews often caught here, by the much longer tail.

So far as is known, *Crocidura miya* appears to be the only Ceylon shrew with a tail longer than the head and body measurement, a fact which makes it easily distinguishable from other shrews.

General appearance is very like the ordinary Mountain shrew, but it would seem to be a finer built little animal.

It is hoped in time to collect some more specimen of this interesting and seemingly rare little shrew, and specially some male specimen so as to make the series complete.

GENUS : FEROCULUS.

Feroculus feroculus Kelaart.

Kelaart's Long-clawed Shrew.

1850. *Sorex feroculus.*—Kelaart. *J. R. A. S.* (Ceylon) p. 325.
1851. *Feroculus macropus.*—Kelaart *Prod. Faun. Zeyl.*, p. 32.
1891. *Crocidura macropus.*—Blanford. No. 119, page 237.
1928. *Feroculus feroculus.*—Phillips. *C. J. of S.* (section B), vol. xiv, part 2, p. 298.
1929.—*Feroculus feroculus.*—Phillips. *C J. of S.* (section B), vol. xv, part 2, p. 117.

While writing these few notes on some little-known small mammals in Ceylon, two more specimen of great interest were collected here, both being fine representatives of the rare Ceylon Long-clawed Shrew.

They were taken in very nearly the same place, amongst some weeds and ' cheddy ' near the small ravine which waters the gardens here.

Both specimen were female, in splendid condition, and have been prepared.

Size.—Large, heavily built, much more robust than the common mountain shrew. Well developed front feet with exceptionally long claws to the large and very noticeable pads. Tail much shorter than head and body, clumsy and not slender. Very small ears.

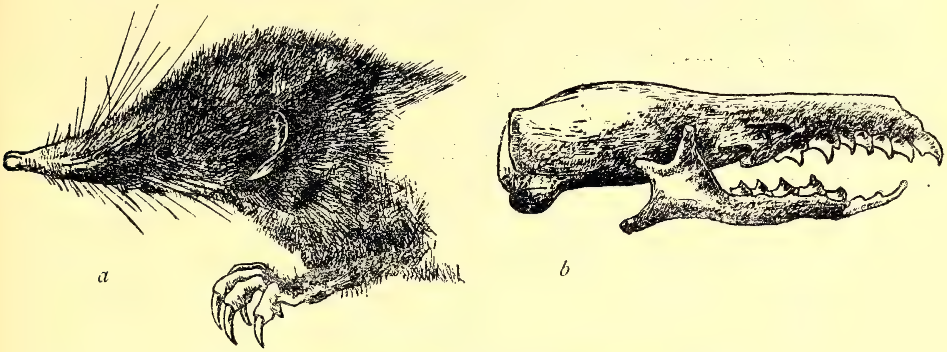


FIG. 1 *a*, Head and forefoot of *Feroculus feroculus*
b. Skull of same.

Colour.—Mole colour, grey-black, the underparts slightly lighter, with a very pretty silvery gloss. Upper lip and chin much lighter, grey to light pink.

Front feet white, hind feet grey-pink. Tail dusky with a few minute white hairs at the tip. Ears dirty grey. Claws white with a reddish mark or line, underneath.

Fur.—Very soft and close, like velvet. Several longer, very fine and soft hairs interplanted, specially over the back and towards the tail. Tiny short hairs very sparsely over the toes and feet. Tail covered with minute hairs, interplanted with several much longer hairs, black with silvery tips.

Distribution.—Kelaart caught several of these rare shrews at Nuwara Eliya in 1850, but only one skin, with the skull missing, existed in the British Museum, until Mr. W. E. Wait preserved a fine male specimen, found on the Horton Plains in 1928.

The Genus, of which there is only one species, is entirely peculiar to Ceylon.

Measurements :

...	Head and body.	Tail.	Hind foot.	Ear.	Sex.
Type ...	106·25	56·25	19·4	7·5	?
Mr. Wait's specimen (in spirits) ...	118	72	20	10	♂

Coll. Number.	Head and body.	Tail.	Hind foot.	Ear.	Sex.
214. (6–8–31)	118	73	20	10	♀
218. (8–8–31)	112	71	20	10	♀

	FRONT FOOT.	LONGEST CLAW.
Mr. Wait's specimen.	12 mm.	6 mm.
No. 214.	13 mm.	5 mm.
No. 218.	15 mm.	6 mm.

Weight of No. 218 was 1¼ ounces.

Parasites.—Both specimen taken here were found to have a few minute red ticks.

Stomach contents.—Vegetable matter and what looked like tiny roots. Of interest to note that No. 214 was trapped with coconut bait, while No. 218 was taken with meat.

West Haputale. Ohyia. August 10, 1931.

(Illustration of head and fore-foot of *Feroculus feroculus*, sketched by Miss Hannie Tutein-Nolthenius.)

SOME NOTES ON THE MONITORS.

By Malcolm A. Smith.

(*With a plate*).

The living Monitors are inhabitants of the Old World, being found in the warm parts of Southern Asia, Africa, the East Indian Archipelago and the Australian region. The large size to which they grow, their general configuration, and in particular the long, slender, bifid tongue, which is retractile into a sheath at the base, as in snakes, are sufficient to distinguish them at once from all other lizards. They have nothing to do with the Iguanas as they are sometimes called, and which do not occur in Asia at all.

The earliest Monitors are known from the Eocene and the bones of fossil forms of somewhat later date and indistinguishable from the species of the present day except that they are larger, have been described by Lydekker from the Siwalik Hills. Some thirty living species are now known, six of which inhabit the Indian Empire.

A critical examination of the specimens in the British Museum (Natural History), the Indian Museum and the Museum of the Bombay Natural History Society which I have recently undertaken has shewn that the distribution of several of the species as given by Boulenger (*Fauna Brit. Ind.*, pp. 160-6) needs correction. His key also for their identification, although admirable when sufficient material is available for comparison, is not so easy when an attempt is made to apply it in the field. It is to be hoped that the new Key given here, when utilized in conjunction with the descriptions given by Boulenger, will enable this difficulty to be overcome.

Key to the Species.

A. Tail round or slightly compressed posteriorly; nostril an oblique slit, nearer to the orbit than to the end of the snout ... *griseus.*

B. Tail compressed, with a low double-toothed crest above.

(*a*) Nostril an oblique slit (sometimes oval in the very young) nearer to the orbit than to the end of the snout.

1. Nostril not twice as near to orbit as to end of snout; nuchal scales not larger than those on crown of head.

Supraoculars not enlarged ... ... *monitor*,

Median supraoculars transversely enlarged ... ... *nebulosus*,

2. Nostril twice as near to orbit as to end of snout; nuchal scales larger than those on crown of head ... *dumerilii*,

(*b*) Nostril nearer to the end of the snout than to the orbit.

Nostril an oblique slit; nuchal scales larger than those on crown of head; snout convex ... ... *flavescens,*

Nostril round or oval; nuchal scales smaller than those on crown of head; snout depressed ... ... *salvator.*

The distribution of the species is as follows :—

1. *Varanus griseus.* The Desert Monitor inhabits the desert region of N.-W. India and westwards through southern Asia to the Caspian Sea and North Africa. It appears to be not uncommon in parts of Rajputana (Jodhpur, Thar, Pakar, Deesa) and has been obtained as far east as Ambala, Agra, and Narsingarh in the extreme north of the Central Provinces. The specimen in the Museum of the Bombay Natural History Society said to have come from Surat is possibly not correctly labelled as regards its locality.

2. *Varanus monitor.* The Common Indian, or Bengal, Monitor occurs throughout the whole of India, Ceylon, Assam and the greater part of Burma, extending south as far as Tharawaddy and the Henzada district in Lat. 17·30° N. It appears to be equally at home in the plains and in the hills up to 6,000 feet. *V. monitor* is the correct name for this species, usually called *bengalensis.* It was first described by Linnaeus in 1758, his description being based upon some beautiful coloured figures in Seba's Illustrations of Natural History. The drawings are very accurate and there can be no doubt as to the identity of the species. Daudin's *bengalensis* was not published until 1802. (Plate, Figs. 1 & 2).

3. *Varanus nebulosus.* The Clouded Monitor is found in southern Burma as far north as Ye (Lat. 15° N.); it is common in the forested areas of northern Siam and extends south throughout the Malay Peninsula. (Plate, Fig. 4).

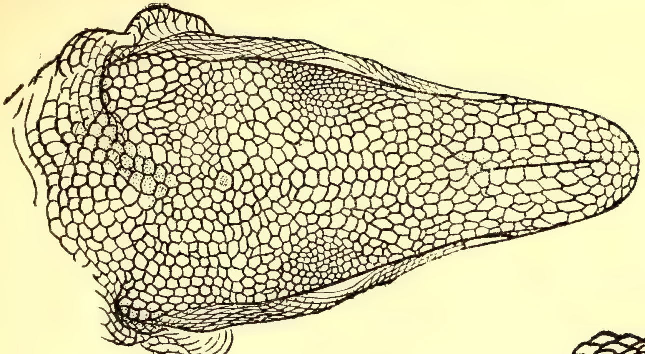
4. *V. dumerilii.* A Malayan species which reaches Indian limits only in the extreme south of Tenasserim. It has been found in Tavoy and is not uncommon along the coast of Mergui and on the islands of the Mergui Archipelago.

5. *Varanus flavescens.* The rarest of all the Indian species, only a few specimens being known in Museum collections. As its distribution coincides with one of the most densely populated parts of India, it may be that it is being gradually exterminated. I have examined specimens from Ambala, Agra, Saran district, and Goalbathan, Pakur and Midnapur in Bengal. (Plate, Fig. 3).

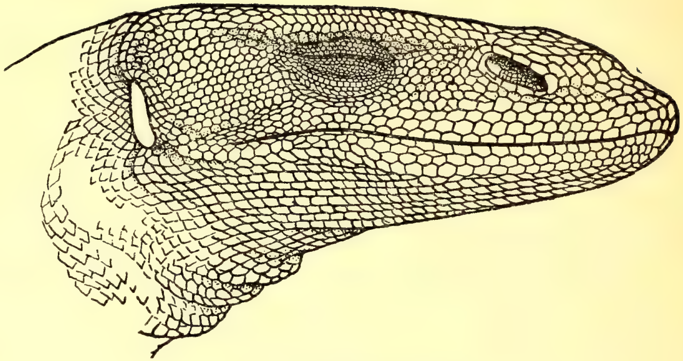
Nothing has been recorded of the habits of this species.

6. *Varanus salvator*, the Water Monitor. Its distribution within Indian limits is unusual and interesting. It is found in Ceylon but is absent from the whole of the Indian Peninsula except in eastern Bengal and the eastern Himalayas. Its occurrence in these districts is probably an extension of its Indo-Chinese range, for it is common throughout Burma and the rest of the Indo-Chinese sub-region.

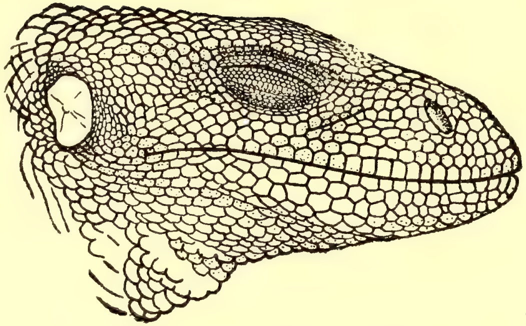
This marked discontinuity in distribution finds a parallel, as far as reptiles are concerned, in *Draco* among the lizards, and *Cylindrophis*



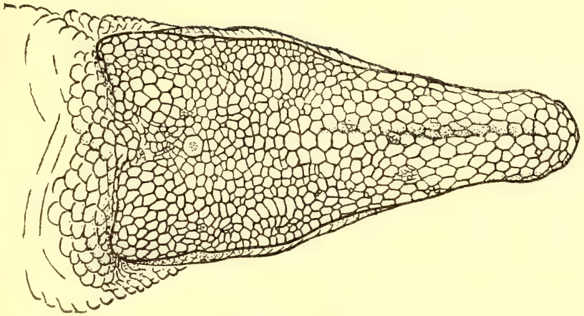
1. *Varanus monitor.*



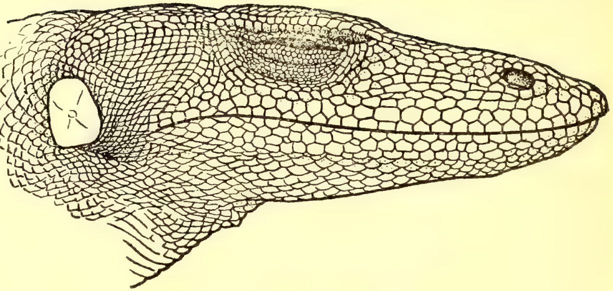
2. *Varanus monitor.*



3. *Varanus flavescens.*



4. *Varanus nebulosus.*



5. *Varanus salvator.*

MONITORS.

among the snakes. The parallel however is generic only and not specific. *Draco dussumieri* occurs in southern India as far north as Madras, *D. maculatus* and *D. norvilli* are found in Assam, the former ranging over the whole of the Indo-Chinese Peninsula. *Cylindrophis maculatus* inhabits Ceylon, *C. rufus*, Burma, Siam and the Malayan subregion. (Plate, Fig. 5).

Mr. H. C. Smith, in a recent article in this Journal (xxxiv, pp. 367–73), has given much interesting information upon the habits of the Burmese species. Of the habits of the species in India nothing has been written.

All the Monitors are carnivorous and they are usually prepared to devour animal food of any kind that they can overcome ; indeed, it is astonishing considering the non-distensible nature of their jaws what large prey they can swallow. Birds and their eggs, small mammals, reptiles, fish, crustaceans and even large insects are all readily devoured, and they are not averse to eating carrion. *V. salvator*, when it lives on the coast, spends much of its time hunting along the shore when the tide is out in search of crustaceans and molluscs.

With the exception of *V. griseus* all the Asiatic species are good climbers and take readily to water. *V. monitor* and *V. nebulosus* are both experts at climbing and can ascend the trunks of large trees with surprising ease and rapidity, depending for their hold upon their strong claws and the roughness of the bark. The two species are very closely allied, *V. nebulosus* being apparently the Malayan representative of *V. monitor*, replacing it in southern Indo-China and the Malay Peninsula. The habits of the two are alike. As far as I am aware, they are the only two Asiatic species that are systematically hunted for their flesh. The natives of Siam hunt *V. nebulosus* with dogs in precisely the same manner as the Burmans hunt *V. monitor* (H. C. Smith, p. 369). *V. prasinus* from New Guinea is said to be entirely arboreal in its habits and its bright green hue is no doubt a protective coloration, the result of environment.

V. salvator is more aquatic in its habits than the other species and is thoroughly at home both in fresh and salt water. In the Gulf of Siam I have seen it swimming between islands that were well over a mile apart. *V. dumerilii* no doubt also swims from island to island in the Mergui Archipelago. *V. griseus* is said to dislike water. Whether it drinks it or not I cannot say but in the desert country in which it lives it must often have to go long periods without water. *V. salvator* can be found on Islands where there is no fresh water except that which is provided by the rain during the wet monsoon. The common African Monitor (*V. niloticus*) is said to be able to remain under water for one hour.

In disposition the Monitors are rather timid. When cornered, they have the habit of inflating the body with air and expelling it with a loud and deep hiss, at the same time lashing furiously with the tail. They seem in fact to rely far more upon the tail as a weapon of offence than upon the teeth, though they are capable of giving a very severe bite. Of their powerful claws with which they could inflict considerable injuries they make no use.

Owing to the size to which the Monitors grow, the preservation of specimens in the field, except very young ones, is not an easy matter. Dried skins are not satisfactory. The best method that I know of is to skin the creature, leaving the head, feet and end of the tail untouched, and then preserve it in spirit (70 per cent) or formalin (2 or 3 per cent). A large skin, when carefully rolled up, can by this means be accommodated in a comparatively small space. Care should be taken, if formalin is used, to transfer the skin to alcohol as soon as possible.

The type of *Varanus* Merrem 1820 is *Lacerta varia* Shaw. The *Stellio* of Laurenti 1768 however has no designated type, and as the genus contains three species which are undoubtedly Monitors, one of which might be selected later as the type, it is necessary to deal with it if the name *Varanus* is to be preserved. In answer to a letter of mine upon this point which I wrote to Dr. Leonhard Stejneger, of the United States National Museum, he has sent me the following, and with his permission I publish it here :—

' Replying to your letter with regard to the type of *Stellio* Laurenti, I will simply quote from an old MS. of mine, which I think covers the case. This MS., which was intended as a critical study of all the genera in Laurenti's book with type fixations and synonymies, has been lying unfinished in my desk for many years waiting for a chance to complete it. The part covering the present case runs as follows :—

' *Stellio* Laurenti includes eight nominal species, none of which can be accepted as type ' solely upon the basis of the original publication ' (Intern. Code, art. 30, I, a-d). As none of the eight species are excluded from consideration in determining the type (same art. II, e-d) and as nobody apparently has selected as yet a type for Laurenti's *Stellio* (in contradistinction to *Stellio* Schneider, 1792, or *Stellio* Latreille, 1802) it seems that I am at liberty to designate the type (same art. g). None of the Recommendations of the Code, appended to art. 30, has any direct bearing on the peculiarities of this case.

' The eight species named by Laurenti were all unknown to him except from Seba's figures and descriptions. Of these there is no difficulty in identifying *Stellio saurus*, *S. salvator* and *S. salvaquardia* respectively as *Varanus niloticus*, *V. salvator* and *V. monitor* (=*bengalensis*) of authors. Authors likewise agree that Laurenti's *Stellio punctatus* is a skink, viz. Linnè's *Lacerta punctata*=*Eumeces punctatus* of Dumèril and Bibron—*Lygosoma punctatum* of Boulenger.

' If Laurenti's *Stellio* were to be restricted to any of these species, it would supplant either *Varanus* or *Eumeces* or *Lygosoma* respectively, as *Stellio* is the older name, a calamity to be prevented if possible.

' There remain four species, however, the identification of which is more or less doubtful, viz.

Stellio saxatilis (Seba, II, 79, 4)
Stellio tessellatus (Seba, I, 76, 2) ' Habitat in Virginia.'
Stellio viridis (Seba, I, 75, 2) ' Habitat in Virginia.'
Stellio thalassinus (Seba, I, 110, 4 and 5) ' Habitat in India orientali.'

The first one Merrem (Syst. Amph. 1820, p. 52) renamed *Agama tetradactyla* because it is distinguished by having four toes on forefeet ; the second and third he considered identical and renamed the compound *Lacerta longicauda* ; the fourth one he referred to *Varanus dracæna* (= *Varanus niloticus*) with a query.

'No one has recognised the *Agama* or the *Lacerta* since. An inspection of Seba's figures shows that Merrem's guesses were not fortunate. In the first place, Nos. 2 and 3 cannot well belong to the same genus, as the former has small head scales and a serrated upper edge to the tail, and the latter has large head shields and no upper tail edge. The former may be some Iguanoid, while the latter shows a certain resemblance to *Tupinambis teguixin.* The fourth is almost certainly not a *Varanus*, and while not showing any shields on the head might with greater probability be referred to *Ameiva.* His guess as to the first would seem to be nearer to the truth, especially when one considers the wide limits of the genus *Agama*, as he understood it, but the character insisted on in Seba's description as well as plainly shown in the figure, viz. only 4 fingers renders any attempt at identification futile.

'Under these circumstances rather than to cause a wholesale mix-up of names current for a century, it seems the better policy to select as the type one of the unidentifiable names, a procedure calculated to lay the specter of *Stellio* becoming active again in herpetological nomenclature. With this in view I designate *Stellio saxatilis* Laurenti the type of *Stellio* Laurenti, Syn. Rept., 1768, p. 56.'

I cannot agree with Dr. Stejneger and other authors that Laurenti's *Stellio salvaquardia*, based on Seba I, 101, represents *Varanus monitor.* The position of the nostril alone, which is at the extreme tip of the snout, is sufficient to justify this view. *Lacerta dracæna* Linnæus, II, 1766, p. 360, referred by authors, with a query, to *V. monitor* = *bengalensis*, is in the same position, for it is based upon the same figure in Seba's 'Illustrations.' On the other hand, Laurenti's *Stellio thalassinus*, based on Seba, I, 110, 4 and 5, might well stand for *Varanus monitor.*

THE BUTTERFLIES OF THE SIMLA HILLS

BY

G. W. V. DE RHÉ-PHILIPE, F.E.S.

Part III

(*Continued from page 429 of this Volume*)

LYCÆNIDÆ

This family, which includes all the Blues, Coppers and Hairstreaks, is, as might be expected, very well represented in the Simla Hills. The palearctic element, which prevails in Kashmir and to the North-West, is here still very strong ; but a number of Indo-Malayan forms are also to be found. Speaking broadly, the species of the *Lycæninæ* group affect the open spaces—gardens, meadows and grass-lands and are, for the most part, rather common and much in evidence ; while the insects of the other groups keep to the forests and wooded valleys and nullahs and have to be searched for.

152. **Castalius rosimon rosimon.** Fabricius.

(Bing. 766 ; deN. 759 ; Ev. H14 (1)).

This beautiful blue belongs rather to the plains of Southern, Central and Eastern India than to the hills. It is not particularly common so far to the north-west, but some may be found along the foot of the hills at almost any time of the year.

153. **Tarucus theophrastus nara.** Kollar.

(Bing. 762 ; deN. 752, 753 ; Ev. H15 (2)).

Common in the plains and submontane tracts, less so in the hills. Anyone looking out for blues is, however, sure to pick up several each year. Is more often seen after the rains and flies in gardens and round meadow flowers.

154. **Tarucus venosus.** Moore.

(Bing. 763 ; deN. 757 ; Ev. H15 (3)).

Considerably rarer than the last, but taken occasionally in the valleys below 5,000 ft. I have it from the Sutlej below Narkanda (September) and from the valley below Kasumpti (October).

155. **Euchrysops cnejus.** Fabricius.

(Bing. 761 ; deN. 745-749 ; Ev. H16 (1)).

Very common in the plains and the outer hills, less so in the inner hills to about 8,500 ft. Flies summer and autumn and, like other species of the group, is fond of fields and roadside hedges.

Euchrysops pandava pandava. Horsfield.

(Bing. 760 ; deN. 750 ; Ev. H16 (3)).

Recorded from the Himalayas, but the Simla Hills seem to be rather beyond its extreme westerly range. It is rare in the Mussoorie Dun where I have taken only one or two, but may possibly extend along the lower hills into our limits. I have noticed that it is fond of leguminous trees and shrubs.

156. **Everes argiades diporides.** Chapman.

(Bing. 735 ; deN. 716 ; Ev. H17 (1)).

Probably more common than would appear from the number actually caught, but it is a small inconspicuous insect which escapes notice. I have taken a few, usually in meadows, in the autumn months between 6,500 and 9,000 ft.

*157. **Everes dipora.** Moore.

(Bing. 735 ; deN. 716 ; Ev. H17 (2)).

The recorded range is from ' Kashmir to Northern Burma ', but seems to be very rare in the Western Himalayas and not common anywhere. I have no personal knowledge of its appearance anywhere west of Sikkim.

158. **Lycænopsis (= Cyaniris) vardhana.** Moore.

(Bing. 685 ; deN. 675 ; Ev. H20 (2)).

Not uncommon in this district at elevations between 6,000 and 9,000 ft. and the observant collector will usually secure all the specimens he needs. There were one or two places about Mashobra, Mahasu and Kufri where I generally found quite a number at some periods of the year. May and June are the best months, but a few may also be seen after the rains. Likes wooded surroundings as a rule, and I have noticed that the Pierid, *Gonepteryx zaneka*, is often found in the same spots.

159. **Lycænopsis albocœrulea.** Moore.

(Bing. 689 ; deN. 678 ; Ev. H20 (6)).

This species is here at its western limits and is distinctly rare in the Simla Hills. My notes show only one taken on the road to Chail in October.

160. **Lycænopsis puspa gisca.** Fruhstorfer.

(Bing. 691 ; deN. 681 ; Ev. H20 (15)).

This butterfly, which is so common in most places within its range, is comparatively rare in these hills. Is rather more likely to be found in the lower valleys, but has been taken in Simla and as high up as Kufri and Fagu. Summer and autumn.

161. **Lycænopsis cardia dilecta.** Moore.

(Bing. 701 ; deN. 689 ; Ev. H20 (18)).

Like *albocœrulea*, is here at the western limits of its range and is very rare. I can record one specimen only, a worn male taken near Kufri village in October.

162. **Lycænopsis huegelii huegelii.** Moore.

(Bing. 704 ; deN. 690 ; Ev. H20 (19)).

No one who takes the least interest in the Simla butterflies can help noticing this beautiul blue. It abounds at nearly all times from March right on to December, flying about the gardens, roadside hedges and shrubs and the sunny clearings in woods. I have seen it as low down as Dharmpore (3,000 ft.) and have taken it at 12,000 ft. on the summit of Huttoo.

163. **Lycænopsis argiolus cœlestina.** Kollar.

(Bing. 703 ; deN. 688 ; Ev. H20 (20)).

Common from the spring to the late autumn and found very nearly everywhere except deep forest from 2,000 to 12,000 ft.

164. **Lycæna astrarche.** Bergstrasser.

(Bing. 705 ; deN. (as *medon*) 647 ; Ev. H23 (9)).

Very plentiful from spring to autumn and to be seen even on warm days in the winter months. Likes open, sunny places and flutters about gardens and the low vegetation along the roads and in meadows.

165. **Lycæna galathea galathea.** Blanchard.

(Bing. 716 ; deN. 665 ; Ev. H23 (15)).

Common in Kashmir, but getting rarer towards the east and distinctly uncommon here. It will be confined to the inner hills. I know of one or two taken beyond Narkanda. Is mainly a spring and early summer butterfly.

*166. **Lycæna pheretes lehana.** Moore.

(Bing. 719 ; deN. 664 ; Ev. H23 (16)).

A species of the high mountains of the interior. It is not likely to be found in the Simla Hills much below 10,000 or 12,000 ft. and must therefore be looked for on the ranges beyond Narkanda and Baghi.

* 167. **Lycæna eros ariana.** Moore.

(Bing. 709 ; deN. 649 ; Ev. H24 (2)).

I have not taken this myself within our area, but it is not uncommon in Kulu and Lahoul and is said to come down to 8,000 ft. in Kumaon so it should certainly be found. I expect the best place to look for it would be in the grass country round Matiana, Narkanda and Baghi in the early summer.

168. **Chilades laius laius.** Cramer.

(Bing. 728 ; deN. 672 ; Ev. H21).

A very common butterfly in the plains and fairly plentiful from spring to autumn in the tracts at the foot of the hills wherever the lime trees grow. Does not, to my knowledge, extend any distance into the hills.

* 169. **Zizera trochilus trochilus.** Freyer.

(Bing. 729 ; deN. 673 ; Ev. H22 (1)).

Is generally common in grass country in the plains and lower hills, though it is usually overlooked owing to its very small size and insignificance. I have not taken it inside our district but it is certain to be found in suitable places round Kalka.

170. **Zizera maha maha.** Kollar.

(Bing. 721 ; deN. 694 ; Ev. H22 (2)).

Very common in the plains and in the country bordering on the plains throughout the year. Extends, though not quite so abundantly, into the hills to at least 9,000 ft., especially in the autumn months. Flies weakly about sunny gardens and grass slopes.

171. **Zizera lysimon.** Hubner.

172. **Zizera gaika.** Fabricius.

173. **Zizera otis otis.** Fabricius.

(Bing. 722-24 ; deN. 699, 702, 703 ; Ev. H22 (3 to 5)).

All these three are really butterflies of the plains, but spread into the outer hills and will be found round Kalka and probably as far as Dharmpore and Solon. Rough grass country is the place to look for them.

174. **Syntarucus plinius.** Fabricius.

(Bing. 764 ; deN. 758 ; Ev. H27).

Not uncommon before and after the rains but, like many of the less prominent blues, often escapes notice. Flies about gardens and shrubs and bushes in the open.

175. **Catachrysops strabo.** Fabricius.

(Bing. 759 ; deN. 743 ; Ev. H28 (1)).

A plains insect and more or less common along the lower hills, but also found occasionally in Simla and beyond up to nearly 10,000 ft. Spring to autumn.

176. **Lampides (=Polyommatus) bœticus.** Linnæus.

(Bing. 772 ; deN. 767 ; Ev. H29).

Common up to 10,000 ft., summer and autumn. The specimens found in the hills do not seem to run to the same size as in the plains where it literally swarms in the spring months.

* 177. **Nacaduba nora.** Felder. (= **ardates.** Moore.)

(Bing. 746 ; deN. 730 ; Ev. H30 (14)).

Nacaduba dubiosa indica. Evans.

(Ev. H30 (15)).

Nacaduba noreia hampsoni. DeNiceville.

(Bing. 743 ; deN. 732 ; Ev. H30 (16)).

The Nacadubas are a difficult genus and Evans' recent rearrangement has meant some reshuffling of the names under which some species were listed by the older authorities. The three mentioned above are the only ones likely to be found in our limits. DeNiceville records *ardates* from Poonch in Kashmir, but I can find no other definite report of any of them having been taken quite so far to the west. I have *nora* (or *ardates*) from the Kumaon and Garhwal terais and *hampsoni* from the Mussoorie Dun, but these are the nearest localities I can vouch for. They may possibly turn up along the foot of the hills ; but will, in any case, be very rare.

Jamides bochus bochus. Cramer.

(Bing. 751 ; deN. 733 ; Ev. H31 (1)).

Jamides celeno celeno. Cramer.

(Bing. 756 ; deN. 738 ; Ev. H31 (6)).

Both these are continental and eastern Himalayan and, as far as I know, there has yet been no definite record from the Simla Hills. Both are to be had in the Mussoorie Dun and their appearance a little bit further west is a possibility. They would only be found in damp, wooded places at the foot of the hills.

178. **Azanus ubaldus.** Cramer.

(Bing. 725 ; deN. 707 ; Ev. H32 (1)).

179. **Azanus uranus.** Butler.

(Bing. 726 ; deN. 708 ; Ev. H32 (2)).

Both these species are fairly common in the Punjab plains and extend a little way into the outer hills, but are much scarcer. They will be found, usually in the autumn months, around the babul trees in the jungle near Kalka.

*179. **Azanus jesous gamra.** Lederer.

(Bing. 727 ; deN. 709 ; Ev. H32 (4)).

A much rarer species of the genus and one I have not taken anywhere in India. It is more a southern and western India insect, but deNiceville records it from Ambala and there is just a chance it may be found with the other two near Kalka.

180. **Heodes (= Chrysophanus) pavana.** Kollar.

(deN. 879 ; Ev. H35 (1)).

Very common, spring to autumn, from 6,000 ft. to the inner ranges. It may be seen every day in gardens, round road side vegetation and in sunny meadows.

181. **Heodes phlœas indicus.** Evans.

Heodes phlœas flavens. Ford.

These are two very slightly differentiated forms of the species more familiarly known to us as *phlœas timeus.* Cramer. Very common at all times except the midwinter months, *indicus* predominating in the outer ranges and *flavens* in the interior, though they overlap considerably.

*182. **Heodes kasyapa.** Moore.

(deN. 881 ; Ev. H35 (7)).

This beautiful 'Copper' is common in Kashmir, less so in Lahoul and Kulu, and very much scarcer further east. Has been recorded by deNiceville as taken 'on the Himalaya Tibet road near Simla' and Evans extends its range to Mussoorie. I have never taken it myself in the Simla limits nor heard of a capture within recent years. On the analogy of its habits in Kashmir, it is most likely to be found in the summer in open spaces in woods at elevations of not less than 8,000 ft. and should be looked for in such surroundings in the Matiana-Narkanda-Baghi country.

183. **Heliophorus (= Ilerda) sena.** Kollar.

(deN. 883 ; Ev. H36 (1)).

Very common spring to autumn. Flies round low vegetation by road sides and in meadows and waste ground.

184. **Heliophorus oda oda.** Hewitson.

(deN. 885 ; as *tamu* ; (Ev. H36 (4)).

Common in Kashmir and fairly so in Kumaon, but seems to be rare in the intervening country. I have taken it on Summer Hill and in the Mahasu woods, but saw very few in the course of all my butterfly collecting in Simla. I have seen it only in the spring and summer.

185. **Heliophorus androcles coruscans.** Moore.

(deN. 887 ; Ev. H36 (5)).

This beautiful insect, very aptly called the 'Green Sapphire' by Evans, is not uncommon in the summer months, though it also flies, much less frequently, after the rains. I found some of the nullahs on the north side of the Mahasu ridge were good spots for this butterfly, but it also comes sometimes into gardens.

*186. **Strymon sassanides.** Kollar.

(deN. 862 ; Ev. H39 (1)).

Is said to be not rare but somehow I have never come across it. Its real home is further to the north-west.

*187. **Euaspa milionia.** Hewitson.

(deN. 876 ; Ev. H41))

Another not uncommon butterfly which, however, I was never able to find. DeNiceville records it as single brooded and flying in May and June. I understand it keeps to damp and shady surroundings where there is bush growth.

188. **Thecla icana.** Moore.

(deN. 871 ; Ev. H42 (1)).

I have a male from Narkanda taken in August, and Col. Evans has caught it on Kufri Hill, also, I believe, in the autumn. The late Col. Chaldecott took several on the Jalauri Pass in August and September. Is not common anywhere.

189. **Thecla bieti dohertyi.** DeNiceville.

(de N. 872 ; Ev. H42 (2)).

Ranges 'from Kulu to Garhwal' but appears to be confined to the inner hills. Col. Chaldecott took a few on the Jalauri Pass at 10,500 ft. in August. This is the only definite record I have of its actual appearance in our neighbourhood.

*190. **Thecla ataxus ataxus.** Doubleday.

(deN. 865 ; Ev. H42 (4)).

Is said to occur from Murree to Kumaon, but is a very rare butterfly which I have not come across.

191. **Thecla birupa.** Moore.

(deN. 870 ; Ev. H42 (12)).

Simla is the western limit of the range of this species and, though fairly common in Kumaon and the Mussorie hills, it is distinctly scarce in our area. I have taken only one or two, flying round the small brown oaks on Kufri Hill in June.

192. **Thecla syla syla.** Kollar.

(deN. 869 ; Ev. H42 (14)).

The only really common species of the genus in Simla and the neighbourhood. It will be found in nullahs and wherever there are oak trees, from 6,000 to 10,000 ft. Flies both before and after the rains.

193. **Thecla ziha.** DeNiceville.

(deN. 874 ; Ev. H42 (18)).

Another very rare butterfly. I know of only one taken in Simla and I myself have not seen it. All the records point to its being a summer butterfly.

194. **Chaetoprocta odata.** Hewitson.

(deN. 877 ; Ev. H43).

If you can hit upon one of the walnut trees which this little chap has taken into favour, you will get as many as you want in an hour or two. It does not, however, distribute itself generally over the country and is abundant only for a very short season in June.

*195. **Curetis acuta dentata.** Moore.

(Bing. 774 ; deN. 858 ; Ev. H45 6)).

This is an insect which has hitherto been looked on as a variety of the changeable *C. bulis*, Doubleday and Hewitson, but Evans has recently separated it as a distinct species. *Bulis* itself has been reported from Mussoorie, but I do not think it is likely to be found as far west as Simla. DeNiceville has recorded *dentata* from Mandi and it is certainly common in the Mussoorie Dun. I can trace no definite record of its appearance in the intervening country, but have no doubt it will be found in the lower hills and valleys.

196. **Iraota timoleon timoleon.** Stoll.

(deN. 775, 776 ; Ev. H46 (1)).

deNiceville records this from Dalhousie and Dagshai and I got a dwarfed and worn specimen one May on the Kasauli road above Kalka. It is always rare in this part of India.

197. **Arhopala (= Amblypodia) dodonæa.** Moore.

(deN. 817 ; Ev. H50 (51)).

198. **Arhopala rama rama.** Kollar.

(deN. 807 ; Ev. H50 (52)).

These two, which have at various times been taken to be dimorphic forms or as the male and female of the same species, are so similar in their habits and haunts that they might well be dealt with together. Their respective specific rank is now well established, but they have much in common and they are often, in flight, mistaken for each other. Both are particularly addicted to wooded nullahs where there is running water, and they frequently settle on damp patches of ground and on the bushes round. They are usually common in such surroundings ; but both, and especially *rama*, may also be found in oak woods and flying into gardens. The best season is before the monsoon, *dodonæa* usually appearing a trifle later than the other ; but they also fly, rather less commonly, from August to October.

199. **Arhopala ganesa ganesa.** Moore.

(deN. 836 ; Ev. H50 (66)).

Habits and seasons much the same as those of the last two species. Its special haunts are damp, shaded nullahs in wooded country, but it may sometimes be taken round oak trees. May and June are the best months, but individuals may occasionally be seen till October.

*200. **Surendra quercetorum quercetorum.** Moore.

(deN. 778 ; Ev. H51 (1)).

Evans gives the Dun as the westerly limit of the range of this butterfly. It is comparatively common there in low jungle along the foot of the hills. Though there is no authentic record of its appearance further west, I should not be surprised if it yet turns up in the very similar country round Kalka.

* 200. **Apharitis lilacinus.** Moore.

(deN. 907 ; Ev. H57 (3)).

This is really a Central India butterfly, and I was very surprised to see that Col. Evans mentioned Hardwar and Kasauli as places where it had been taken. I include it in the list on his authority, but its appearance here must be very exceptional.

201. **Spindasis (= Aphnæus) vulcanus vulcanus.** Fabricius.

(deN. 903 ; Ev. H58 (1)).

Mainly an insect of the plains, but will always be found, though never plentifully, in the lower hills from Kalka to Dharmpore and Sabathu and, rarely, even as high up as Simla and Mashobra. I have taken one or two specimens in June. It keeps to open, sunny surroundings and flies about shrubs and low trees.

* 202. **Spindasis ictis ictis.** Hewitson.

(deN. 914 ; Ev. H58 (5)).

I have not seen this in the Simla district. DeNiceville records it from Mandi in the Western Himalayas and it should occur but must be very rare.

203. **Spindasis elima uniformis.** Moore.

(deN. 919 ; Ev. H58 (6)).

Said to be not rare but I have only come across it once in our area when I took a specimen on the eastern slopes of the Chail ridge in June. It is fairly common between Mussoorie and Chakrata in the autumn and, since it extends to Kashmir and Chitral, one would expect to pick it up more frequently here. Like all the *Spindasis,* it flies fast and settles unobtrusively and calls for a quick eye for detection and capture.

* 204. **Spindasis nepalicus nepalicus.** Moore.

(deN. 923 as *zaffra* ; Ev. H58 (8)).

deNiceville has recorded this insect from Kulu in June and Mackinnon from Mussoorie in May. It is rare and I have not seen it within the district.

Spindasis lohita. Horsfield.

(deN. 910 ; Ev. H58 (12)).

DeNiceville refers to *lohita* as being found throughout the Himalayas, while Evans states that the Himalayan local race, *himalayanus,* Moore, is to be found only from Sikkim eastwards. I have taken one or two of the *lohita* group at Ranibagh in Kumaon, but I doubt very much whether any will be found as far to the west as Simla.

205. **Pratapa (=Camena) icetas icetas.** Hewitson.

(deN. 897 ; Ev. H61 (5)).

A rarity throughout its range from Kashmir to Kumaon. DeNiceville mentions captures on Tara Devi. Coming to more recent years, my notes record three only—two on Summer Hill and one at S. Damiano, Mashobra. These three were all in open spaces in woods between June and August.

Tajuria cippus cippus. Fabricius.

(deN. 931 as *longinus* ; Ev. H65 (6)).

Tajuria is a genus which belongs rather to the Eastern Himalayas and Malaya and *cippus* is the only one of its species at all likely to be found so far west. It is stated to occur throughout the outer Himalayas, but I cannot trace any authentic record of its appearance in the Simla Hills. I have taken it in Kumaon and know of a capture near Saharanpore. It may turn up at lower elevations in the District.

206. **Horaga onyx onyx.** Moore.

(deN. 960 ; Ev. H82 (1)).

Kulu, Kangra and Dehra Dun are all mentioned as places where this butterfly has been taken, so it should occur in the intervening tracts. I have seen one in a collection at Simla but the exact locality was not given. I have not myself found it in this part of the country, and it is presumably very rare here.

* 207. **Horaga viola.** Moore.

(deN. 965 ; Ev. H82 (4)).

A species which ranges from Kangra to Burma but is rare everywhere. I have never found it in the Simla Hills and cannot trace any definite record of a capture here.

208. **Deudoryx epijarbas ancus.** Fruhstorfer.

(deN. 986 ; Ev. H88 (1)).

Not uncommon in June and July. Though strong and rapid fliers, they are easy to catch as they are fond of coming into gardens and settling on flowers. I took several in this way.

209. **Virachola perse perse.** Hewitson.

(deN. 1013 ; Ev. H89 (3)).

Occurs from Kangra eastwards, but is very rare here near the westerly limit of its range. One taken ' somewhere near Kalka ' by a soldier collector is the only actual case of capture in the district that I know of. It is elsewhere fond of guava plantations, and these will be the best places to look for it. Will not usually be found much above the 3,000 ft. level.

* 210. **Rapala varuna grisea.** Moore.

(deN. 999 ; Ev. H90 (10)).

A rare butterfly. I have only taken it at low elevations in Kumaon, but there is a record of a capture in Kangra and it should be found in the country between.

* 211. **Rapala melampus.** Cramer.

(deN. 1006 ; Ev. H90 (15)).

Occurs at low elevations from Murree eastwards, but is rare west of Mussoorie. I have not taken it in the district.

212. **Rapala nissa nissa.** Kollar.

(deN. 1002 ; Ev. H90 (18)).

Quite the most common representative of the genus in the Simla Hills. They were sometimes to be taken in plenty dashing round and settling on low growing shrubs in some of the wooded nullahs behind Jakko and Mahasu in June and July just before the rains. Occasionally come to the flowers in gardens. I have not seen it below 6,000 ft. in the Simla Hills.

213. **Rapala micans selira.** Moore.

(deN. 990 ; Ev. H90 (19)).

Not uncommon. May, between May and September, be picked up at any time and anywhere except very bare country. Seems to be specially attracted by wild indigo flowers. Does not appear to venture below 5,000 ft. and will probably be found up to 10,000 ft.

* 214. **Sinthusa chandrana chandrana.** Moore.

(deN. 1017 ; Ev. H91 (2)).

*215. **Sinthusa nasaka pallidior.** Fruhstorfer.

(deN. 1015 ; Ev. H91 (3)).

Both have been recorded from ' Kangra to Kumaon ' and as being rare. I have not found any of the genus anywhere west of Sikkim. They appear to fly only in the spring and summer and will probably not be found below 5,000 ft.

HESPERIDÆ

The ' Skippers,' as a general rule, receive very little attention from the ordinary collector. The butterflies of which the family is composed are, with a few exceptions in the Indo-Malayan groups, small, dingy and inconspicuous insects. Only a small proportion of the numerous species display any partiality for open country or venture into gardens and habited places. Most of them and all the finer species, avoid flying in the open and prefer to hide in wooded ravines and forest clearings which are not easy of access. Several species fly only in the early mornings or in the dusk of twilight.

It is therefore not a matter for surprise that the family should be poorly represented in most collections. Only in the Natural History museums and in the larger specialist collections is it given the place it should have ; and even these are often not as complete as their curators would wish.

It is possible that greater interest might have been stimulated had either DeNiceville or Bingham been able to complete their works on the butterflies of India. But neither ever reached the *Hesperidæ* ; and the few collectors who did take notice of the skippers had to work under handicap. Watson's *Hesperidæ Indicæ* furnished descriptions, but it lacked a key and, in the light of our later knowledge, was very incomplete. He later supplemented the book with a key which appeared in the *Journal of the Bombay Natural History Society* in 1895 ; and this, with the *Revision of the Oriental Hesperidæ* published by Elwes and Edwards in the Transactions of the Zoological Society in 1897 provided the means for diagnosing and recognising the various members of the family. Unfortunately these and the notes and descriptions of genera and species which appeared from time to time in the *Journals of the Bombay N. H. Society* and in other scientific magazines and proceedings seldom reached the ordinary collector.

We are in a better position now. Moore's *Lepidoptera Indica* has been completed though its expense puts it beyond the reach of most ; and Evans, in his *Identification of Indian Butterflies* has, after much research, worked out a comprehensive and up-to-date key which will be invaluable. A handbook with descriptions of species is, however, still badly wanted ; and it is to be hoped that the *Fauna of India* series will soon be completed to meet the need.

The North-West of India—plains and hills—is not a prolific Hesperid country. Still Evans, whom I follow throughout in the list below, has been able to specify thirty species as occurring in the stretch from Kangra to Mussoorie which includes the Simla Hills. It is probable that some others, either of the Palearctic type of the north and north-west or of the Indo-Malayan groups which extend into Kumaon and Mussoorie, will yet be discovered in the Simla district.

Information as to the habits, seasons of appearance and particular localities affected by species of a family which has been so neglected by the generality of collectors is necessarily scanty. It is not as complete, as applicable to the Simla district itself, as I would wish ; but I am able to supplement it to some extent by the analogy of the ways of the species or connected races in localities where my opportunities for field observation have been greater. I am also indebted to General Evans for some notes of his own experiences of the *Hesperidæ* in the Simla Hills.

The references, other than those to Evans' *Identification*, are to Watson's *Hesperidæ Indicæ* or to Journals where detailed description of the butterfly may be found.

216. **Hasora alexis alexis.** Fabricius.

(Ev. i. 1 (12) ; Hesp. Ind. 19).

Occurs in the plains and foothills, but is very local in its habits. A species of low tree seems often to attract it and I have found it flitting round these in the Punjab plains and once on the railway line just above Kalka. It usually appears during or just after the rains and flies more freely in the evening than by day.

Bibasis sena sena. Moore.

(Ev. i. 3 ; Hesp. Ind. 17).

This species has a wide range throughout Eastern and Continental India and along the Himalayas westward as far as Mussoorie. Though not yet recorded from the Punjab, I should not be surprised if it is found by someone who has opportunities for sedulously working the country along the foot of the hills,

217. **Rhopalocampta benjaminii benjaminii.** Guerin.

(Ev. I. 5 ; Hesp. Ind. 3).

This beautiful skipper is fairly common in Sikkim and Assam but is distinctly rare in the Central and Western Himalayas. It is possible that it is less a rarity than it appears to be ; but it is one of the species which seems to fly only in the very early morning and therefore escapes notice. I have only taken one in the Simla region. It was quite an unexpected find. Travelling up by the Railway one June, the train halted in the early morning at Koti station ; and, while it waited, I saw a butterfly settle on some shrubs near. I had no net, but managed to knock it down with my hat ; and was delighted to discover it was a male '*benjaminii*.' I have taken it from early spring to autumn in the Khasi Hills.

218. **Badamia exclamationis.** Fabricius.

(Ev. I. 6 ; Hesp. Ind. 1).

Generally common throughout India and extends into the hills to 7,000 ft. at least, though it is rarer here. I have seen it in Simla. Occurs summer and autumn, and flies very rapidly around low trees and hedges. The larva feeds on a species of Bignonia.

*219. **Celænorrhinus pulomaya.** Moore.

(Ev. I. 16 (5) ; Hesp. Ind. 185).

Recorded from Kangra to the Naga Hills. I have never come across it anywhere west of Sikkim, and Evans tells me he never took it in Simla.

220. **Celænorrhinus leucocera leucocera.** Kollar.

(Ev. I. 16 (13) ; Hesp. Ind. 192).

Common in the east and central Himalayas, less so in the western. It usually keeps to shaded nullahs and forest glades during the day, but sometimes flies into Simla gardens at dusk. I have only noticed it after the monsoon.

* 221. **Celænorrhinus munda.** Moore.

(Ev. I. 16 (15) ; Hesp. Ind. 194).

Said to be not rare from Murree eastwards, but neither Evans nor I ever took it in the Simla district and I have not seen it anywhere west of Kumaon. Would have the same habits as the preceding ; and, since it is superficially like it, might easily be mistaken for *leucocera* if only seen in flight.

* 222. **Achalarus bifasciatus casyapa.** Moore.

(Ev. I. 18 (2) ; Hesp. Ind. 224).

A western Himalayan butterfly which is very rare everywhere in its range. I have only a single specimen, taken in Mussoorie in July, as a result of many years' collecting. I found the eastern race, *liliana,* not very rare in Shillong where it was much addicted to flying in the neighbourhood of waterfalls, in and out of the spray.

Satarupa sambara dohertyi. Watson.

(Ev. I. 19 (2) ; Hesp. Ind. 130).

Though not yet recorded from anywhere west of Mussoorie, it is just possible that it may be found very rarely in the Simla district. Its haunts would be near wooded streams at low elevations.

Tagiades atticus khasiana. Moore.

(Ev. I. 20 (1) ; Hesp. Ind. 136).

A wide spread species which is usually common where it occurs. Though not yet reported from anywhere west of the Mussoorie Dun, a rare straggler or two may possibly find its way into the similar country along the foot of the Simla Hills.

* 223. **Tagiades menaka.** Moore.

(Ev. I. 20 (8) ; Hesp. Ind. 141).

Found along the Himalayas from Kashmir to Burma and China, but is common only in the east. I got a solitary specimen at 6,000 ft. below Dalhousie and found it fairly plentiful at low elevations in Kumaon ; but have never seen it anywhere in the intervening tract. Evans notes it as ' rather rare ' in the Simla Hills ; and it certainly needs a lot of looking for. It keeps to damp, wooded glens, preferably near water ; and its snow-white hindwings make it conspicuous as it flashes about in these surroundings. It settles suddenly with outspread wings on the underside of a leaf and, in doing so, disappears as if by magic. I have taken it from spring to autumn where it is common.

It is worth while noting that, though the next species, *T. litigiosa litigiosa.* Mosch., is supposed to be restricted to the Eastern Himalayas, I have taken typical specimens below Mussoorie and in Kumaon.

224. **Coladenia dan fatih.** Kollar.

(Ev. I. 25 (2); Hesp. Ind. 169).

Should not be rare but is very seldom seen. I have only one specimen from the district—taken in the nullah near Barogh in August. It affects damp country with plenty of undergrowth ; and, like the last, flies quickly and settles suddenly.

* 225. **Sarangesa purendra.** Moore.

(Ev. I. 26 (2) ; Hesp. Ind. 71).

Has a range from Kangra to Kumaon and is said not to be rare. I have, however, not found it common anywhere and neither Evans nor I ever got it in the Simla district. The few specimens I have secured in other districts have always been before the monsoon in rather dry scrub country at the foot of the Hills. Such a small greyish insect easily escapes notice.

226. **Sarangesa dasahara dasahara.** Moore.

(Ev. I. 26 (3) ; Hesp. Ind. 72).

The races of *dasahara* are found all over India except the extreme north-west and are generally common everywhere. I have only one from the Simla region—taken at Kalka in May—but it is probably not uncommon in the outer hills and the plains adjoining. Being, like the last, very inconspicuous, it wants looking for.

* 227. **Odontoptilum angulata.** Felder.

(Ev. I. 31 (1) ; Hesp. Ind. 153).

Common from Kumaon eastwards but distinctly rare in the Western Himalayas. I have not taken it in the Simla Hills, and Evans tells me he also had not found it here. I have caught it at 5,000 ft. near Mussoorie, but it is more likely to occur in the lower valleys round Kalka. Flies spring and autumn.

Caprona ransonnettii potiphera. Hewitson.

(Ev. I. 32 (1) ; Hesp. Ind. 149).

Never actually recorded from these hills, but it has been noted from the Punjab and I have taken it in the Mussoorie Dun, so that there is considerable chance of its turning up in the country round Kalka.

228. **Hesperia galba.** Fabricius.

(Ev. I. 34 (1) ; Hesp. Ind. 220.

I have not taken this myself anywhere in the Simla district, and Evans notes it as ' rare '. I have only taken it elsewhere in the plains and the country bordering on them, so I fancy it is more likely to be found in the tracts round Kalka. It flies both spring and autumn and affects open grass meadows.

Though no other *Hesperia* has yet been recorded from the Simla Hills, I think it is more than probable that one or two of the palearctic species, such as *H. alpina cashmirensis*, Moore, which are found in Turkestan, Tibet and Kashmir, will be discovered in the high interior country.

* 229. **Aeromachus inachus stigmata.** Moore.

(Ev. I. 58 (2); Hesp. Ind. 94).

Said to be found throughout the Himalayas from Murree eastwards. I have, however, never found it anywhere west of Naini Tal, and Evans tells me he did not get it in the Simla hills. It is not really common anywhere and seems to be very rare in the western part of its range. Flies just before the monsoon in Kumaon.

230. **Suastus gremius gremius.** Fabricius.

(Ev. I. 62 (1); Hesp. Ind. 66)

Common in many parts of the plains in India but does not seem to extend much into the Punjab and is definitely rare in the North-Western Himalayas. I have only taken a couple in Simla, both after the rains on flowers in my garden.

231. **Udaspes folus.** Cramer.

(Ev. I. 73 (1); Hesp. Ind. 176).

A larger and rather more striking insect than most of the Northern Hesperidæ which does sometimes find its way into the ordinary collector's bag. It is not common in the hills and I have not seen it flying anywhere in the Simla Hills myself. I once noticed one in a soldier's collection made around Sabathu and it is probably more likely to be found in the lower country. It is not uncommon in the Oudh plains and in the outer hills in Kumaon, where I have also taken it as high up as 7,000 ft. Flies by day and in the evening round shrubs and moves very quickly so that a flash of white is all one sees.

232. **Notocrypta feisthamelii alysos.** Moore.

(Ev. I. 74 (4); Hesp. Ind. 177)

Another very rapid flier, darting from bush to bush, and terribly easy to lose sight of even after being glimpsed. It is to be found along the Himalayas from Murree eastwards but only becomes common from Kumaon. I have seen it only twice in the district—once at Barogh and once near Shogi station on the railway up. Flies summer and autumn.

Erionota thrax thrax. Linnæus.

(Ev. I. 76 (1); Hesp. Ind. 155).

Has not yet been recorded from the district, but it is found from the Mussoorie Dun eastwards and there is just a chance it may appear in the country at the foot of the hills. It is rare except in the extreme north-east and Burma. The place to look for it would be in plantain groves.

* 233. **Hyarotis adrastus praba.** Moore.

(Ev. I. 82 (1); Hesp. Ind. 166).

Found from Kangra eastwards along the Himalayas, but is apparently very rare anywhere west of Kumaon. Neither Evans nor I ever got a specimen in the Simla Hills. Would, I think, be more likely to be found at low elevations.

Halpe moorei. Watson.

(Ev. I. 99 (26); Proc. Zool. Soc. 1893, p. 109).

The Halpes are a very large group of which one or more members are found in nearly every part of India except, perhaps, the extreme north-west. None have yet been recorded from anywhere in the Punjab; but *moorei* is one of the most wide-spread and common species and has been found in the Mussoorie hills. It may extend rarely into the Simla district.

* 234. **Actinor radians.** Moore.

(Ev. I. 102 ; Hesp. Ind. 105).

This species has a range from Chitral to Kumaon but is rare everywhere. Neither Evans nor I got it in the district. The only specimens I have ever taken were on a single occasion when I came across a small colony of them one March in a rocky nullah in the Sewalik Hills near Hardwar.

235. **Taractrocera danna.** Moore.

(Ev. I. 105 (1) ; Hesp. Ind. 88).

A common but rather elusive little beggar. It is such a small and quick-flying insect that it easily escapes the eye. I found it fairly plentiful on some of the open grassy slopes of the hills round Mahasu and on the Chail road in May and June, but never got it after the monsoon. It darts about the flowers in the grass but settles frequently.

* 236. **Taractrocera mævius flaccus.** Fabricius.

(Ev. I. 105 (2) ; Hesp. Ind. 86).

A butterfly of the plains found more or less generally over India. I have never seen it in the Simla Hills but it will probably occur—though not commonly —at lower elevations round Kalka.

237. **Padraona dara dara.** Kollar.

(Ev. I. 106 (7) ; Hesp. Ind. 78).

Another of the small, rapid-flying butterflies which escapes notice but is probably more common than one might judge from the number found in a catch. It darts about bushes and small trees in sunny surroundings and goes to flowers if there are any about. Flies May to October from 4,000 ft. upwards.

* 238. **Telicota pythias bambusae.** Moore.

(Ev. I. 108 (2) ; Hesp. Ind, 75).

Though recorded as an all India butterfly, this insect really belongs to the plains and lower hills, and I have never found it anywhere above 2,000 ft. or so. I have not caught it in the Simla district, but it must occur around Kalka, after the rains being the most likely time.

Augiades brahma. Moore.

(Ev. I. 109 (8) ; Hesp. Ind. 77).

Said to be not rare from Mussoorie eastwards and may possibly extend into the fringes of the district.

* 239. **Pamphila comma dimila.** Moore.

(Ev. I. (110) ; Hesp. Ind. 228).

A palearctic species which is found along the inner ranges of the Himalayas from Chitral to Kumaon. I know of no actual record from the Simla district; but it will very probably be found in the higher hills of the interior in the Chini neighbourhood.

240. **Baoris sinensis sinensis.** Mabille.

(Ev. I. 115 (5) ; Hesp. Ind. 38).

I have not taken this species in Simla myself, but Evans tells me it is not rare especially around Mahasu. It is a quick-flying insect, and flits about flowering shrubs in the open and is noticeable when present, so it should not ordinarily be missed. Flies both summer and autumn elsewhere.

* 241. **Baoris mathias mathias.** Fabricius.

(Ev. I. 115 (6) ; Hesp. Ind. 35).

A very common insect of the plains. Neither Evans nor I got it in Simla but it is certain to occur at lower elevations and should be looked for among the shrubs and small trees which clothe the low hills near Kalka. It is on the wing at all times except the very cold months.

242. **Baoris discreta himalaya.** Evans.

(Ev. I. 115 (20) ; Rev. Oriental Hesp. p. 282).

Though not usually rare where found, I have not seen many in the Simla region. Like most of the other species of *Baoris,* it frequents shrubs and flowers and flies most of the year. I fancy that anyone who keeps a sharp look-out for butterflies of the genus will find it is more common than might be imagined.

243. **Baoris guttatus guttatus.** Bremer and Grey.

(Ev. I. 115 (28) ; 1 Hesp. Ind. 41).

Baoris guttatus bada. Moore.

Two very slightly differentiated races of the common *guttatus*, the former being the hill variety found above about 2,000 ft. while *bada* keeps to the plains. In Simla, *guttatus* does not seem to fly much before the rains, but is common after. It flits like a little brown speck about and across gardens but often settles on flowers and can easily be taken. *Bada* will probably be found round Kalka and Ambala.

244. **Baoris zelleri colaca.** Moore.

(Ev. I. 115 (30) ; Hesp. Ind. 43).

Also common in the plains generally, but does not seem to extend much into the hills. I have taken only one specimen in Simla, but it should be more prolific in the country at the foot of hills. Its habits and seasons are like the preceding species.

245. **Baoris bevani bevani.** Moore.

(Ev. I. 115 (31) ; Hesp. Ind. 44).

Also of similar habits and seasons, but far more frequently met with in the hills. I got several in my garden in October one year.

* 246. **Gegenes nostradamus.** Fabricius.

(Ev. I. 116 ; Hesp. Ind. 39).

A common but, judging by the few one gets hold of, a very elusive little butterfly. Neither Evans nor I ever caught any in and around Simla ; but it is found all over the Punjab plains and I have it from below Dalhousie and one from Almora so that it will probably be found in the low valleys.

THE STUDY OF INDIAN BIRDS.

BY

HUGH WHISTLER, F.Z.S., M.B.O.U.

PART IX.

(*With a plate and a text-figure.*)

(*Continued from page 324 of this volume.*)

THE REPRODUCTION OF BIRDS.

The Egg.

There are many aspects to the study and interest of Birds and their lives ; but it is quite safe to say that by far the most popular is that of their eggs. There is something peculiarly attractive about an egg itself. It is so clean and neat an object. It is often surprisingly beautiful, even apart from the perfect setting of its nest. To search for nests is to combine the pleasures of nature and of sport. A day's bird-nesting is a day spent in the open air. The careful search and the patient watching necessary for more than a mere occasional success brings one in touch with every aspect of nature. Exercise and pleasure and interest are all combined. Whilst the attainment of the specially coveted eggs may imply all the care and skill, the extended expeditions and the actual dangers of which the sportsmen's trophies too are only the symbol and memento.

The egg appeals also to the orderly mind of the born collector. A collection of eggs like a collection of stamps affords an outlet for all his instincts of neatness and acquisition. He is able to blow the egg neatly, label it neatly and arrange it with loving care and precision. The amassing of a large number is within the means of the most moderate income. The infinite varieties found in a single species provide an excuse alike for wholesale depredations and extreme specialisation.

It is therefore eminently pardonable, to use Professor Newton's words, for the victims of this devotion to dignify their passion by the learned name of 'Oology', and to bespeak for it the claims of a science. Though there can be little doubt that the study of Oology has not conferred benefits on scientific Ornithology at all commensurate with the number of its votaries and the time which they have spent on it.

However that may be, we are here concerned with the egg chiefly as an item in the story of the reproduction of birds.

We have already seen that one of the characteristics which Birds retain from their reptilian ancestry is the fact that they are oviparous, that is, produce their young through the medium of eggs. The eggs of many present-day reptiles are essentially the same as the eggs of birds, though the majority of them have not attained to quite the same degree of development in the formation of hard shells. The number of eggs laid in the clutch has with development decreased amongst birds.

Before describing the egg itself it is desirable to describe briefly the reproductive organs of the parents and give a brief summary of the development of the egg.

In both sexes of a bird the reproductive organs are situated against the upper wall of the abdominal cavity at the anterior end of the pelvis. This corresponds roughly to what in ourselves we should describe as the small of the back or the region of the kidneys.

In both sexes the organs consist of paired germ-producing glands and their efferent ducts, but it will be most convenient to consider the sexes separately.

In the male the testes are a pair of whitish-yellow glands, oval, globular or occasionally kidney-shaped or vermiform which lie at the anterior end of the kidneys. Within each testis there is a multitudinous multiplication of germ-cells from which the spermatazoa pass into a convoluted body known as the epididymis and thence into the main duct the *vas deferens*,[1] a narrow tube which extends along the inner wall of the abdominal cavity to the cloaca or vent. The ends of the two *vasa deferentia* are often slightly dilated to form seminal vesicles, that is store-chambers for the spermatazoa. The *vas deferens* is typically of a slightly zigzag character.

These parts of the male reproductive system should be clear after reference to the illustration (Fig 1). It must be understood that, except in the Ratitæ and certain other forms such as the Coracidæ and some of the ducks, the male bird has no penis. The end of the cloaca has to act for it.

During the breeding season, these organs, which at other times are very minute in size, become greatly enlarged. The testes in the House-Sparrow (*Passer domesticus*), for instance, grows from the size of a minute pin's head to that of a ground-nut, temporarily even displacing the usual arrangement of the intestine, liver and stomach. The two testes are then often rather different in size, and also sometimes in shape. The *vasa deferentia*, also increase considerably in length, the extra length forming a closely convoluted mass round the entrance to the cloaca, causing it to protrude and in some dried skins to assume a character and shape which lead to much misunderstanding.

In the female bird a pair of ovaries are developed in the same position as the testes of the male. With rare exceptions, however, the right ovary dwindles and disappears at an early stage of growth. The known exceptions are chiefly amongst the birds of prey and an example of the presence of a double set of ovaries will be easily found by any one who troubles to dissect the female of the Indian Shikra (*Astur badius*). It is not known why the right ovary should disappear in most species, or why it should be retained in the few exceptions. It does not appear to function and even when it remains the right oviduct remains quite vestigial.

The ovary consists of a mass of embryonic eggs, several hundred in number which may be described as presenting the appearance of a minute cluster of grapes.

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[1] Care must be taken to distinguish the *vas deferens* from the ureter which lies parallel with it.

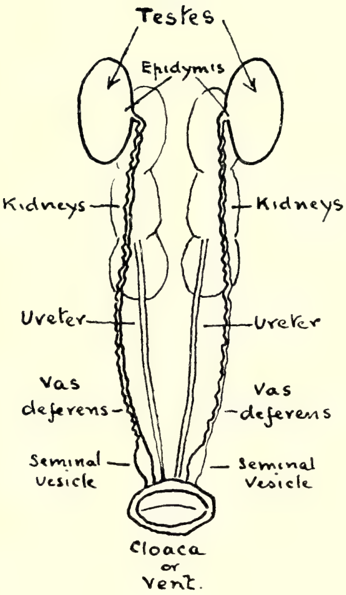
Testes
Epidymis
Kidneys
Kidneys
Ureter
Ureter
Vas deferens
Vas deferens
Seminal vesicle
Seminal Vesicle
Cloaca or Vent.

Fig 1
MALE ORGANS OF
A BIRD.
(enlarged in the
breeding season).

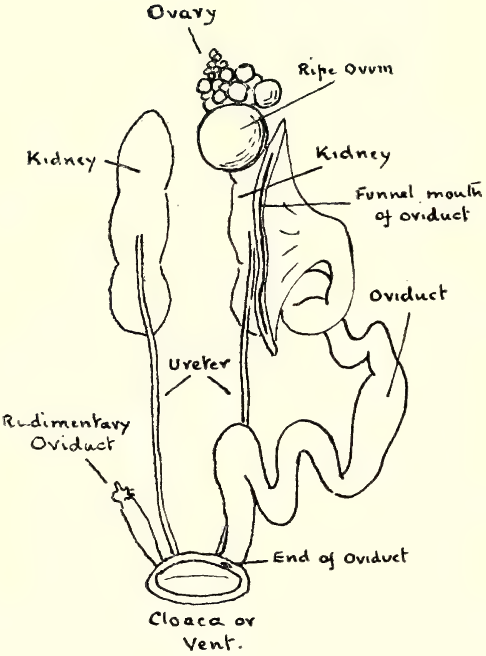
Ovary
Ripe Ovum
Kidney
Kidney
Funnel mouth of oviduct
Oviduct
Ureter
Rudimentary Oviduct
End of Oviduct
Cloaca or Vent.

Fig. 2
FEMALE ORGANS
OF A
BIRD.
(enlarged in the
breeding season).

The oviduct is a gut-like tube which passes from the neighbourhood of the ovary down to the left side of the cloaca. Its upper end is wide and trumpet-shaped, free in structure but in position pressed against the ovary. The lower end enters the cloaca close to its external entrance. (Fig. 2).

As in the male the female organs increase tremendously in size with the breeding season. The ovary which at other times may appear to the naked eye as a mere indistinct film with no granular structure becomes a big bunch of eggs in every stage of development from a microscopic object to a full-grown ripe ovum with a large amount of yolk. So with the oviduct. In the common Fowl, according to Gadow, the oviduct is normally six or seven inches long and scarcely a line wide; but at the time of laying eggs it becomes more than two feet in length and nearly half an inch in width. Its volume thus increases about 50 times, and this is an annual change with all wild species.

It is clear from the fact that both male and female organs lie dormant for part of the year and then exhibit a huge seasonal enlargement; that birds cannot indulge in coition and breed just when the fancy takes them. Their breeding is necessarily a seasonal affair, dependant on the development of the organs which must arise from either external or rhythmic stimulus. This stimulus, obscure in origin though it may appear to be, acts so far as we know on each sex separately.

If an observer in the Kashmir valley in spring makes a systematic collection of a series of starlings *(Sturnus v. humei)* which have returned there for breeding he will find that the males have the testes fully developed at the time when the female ovaries only show a slight enlargement.

At first thought one is inclined to think that this implies that stimulus from the male awakens the female. It is not so however. The male and female organs both awaken in response to a common external stimulus. The male however develops the more quickly because his function is required in the early stages of the eggs, before they have enlarged enough to bring the ovary to its maximum.

Being now, I hope, familiar on broad lines with the reproductive organs of both sexes we can proceed to consider the process leading up to the production of the perfect egg.

As any observer may see for himself the union of a pair of birds—insemination as it should properly be called—is a very brief affair, a matter of seconds usually. The purpose is of course the transference of the spermatazoa from the male to the female, but fertilization cannot be said to have taken place until the spermatozoa meet the ova themselves.

I am not competent to describe the minute and obscure processes involved in the reproduction of the young bird; but put briefly and generally, it is something like this.

The ovum (the female germ) and the spermatozoom (the male germ) each contain nuclear rods known as chromosomes. These are the vehicles of the hereditary equipment of the bird and they are set aside in the earliest stage of embryonic development, so that one may almost say that the 'hereditary formula' which makes the bird passes direct from generation to generation independent of the life history of the individuals. (It is on this fact that all the controversies as to the inheritance of hereditary and acquired characteristics hang.) In the ovum (while still in the ovary) and in the spermatozoon, these chromosomes divide as part of their normal maturation, and fertilization consists of the reunion of the chromosomes, half from the male germ and half from the female germ, to form again the complete unity which is then gradually clothed anew in a fleshly envelope, a fresh unit or segment of the generations which are the vehicle for the 'hereditary formula'. The mother body no doubt provides much of the raw material which forms the envelope, but it is clear from the fact that each parent provides half the chromosomes, how intimately and how subtly the young creature has exactly half its essential self from each parent.

The spermatozoa of birds are not similar in appearance for all species. They are of course exceedingly minute—it is said that a hundred can swim about in a drop of fluid suspended by the head of a pin—and they consist of three parts, a head, a centre and a long tail. The head contains the chromosomes. The centre contains a minute body called the centrosome. The tail is purely locomotive in purpose. Its moves drive the head along. It is in the nature of typical spermatozoa to move against a current. After insemination the spermatozoa left by the male in the cloaca of the female move, driven by their long tails, up the slight downward current of secretion in the female oviduct until they meet the ova. This may apparently be either in the mouth of the oviduct or in the ovary itself.

To return for the moment to the question of the ova. With the beginning of the breeding season the immature ova on the surface of the ovary start to accumulate yolk, that is nutritive fatty material which is brought to them by the blood and the lymph. They start irregularly so that many different sizes of immature eggs may be seen in the ovary. Then as an egg ripens it bursts from the capsule in which it grew and is caught by the trumpet-shaped mouth of the oviduct. At this stage either before, or generally after, the bursting of the capsule the egg is fertilized by the spermatozoa. If fertilization does not take place the egg may go through its normal development and be laid, all to no purpose. Or undeveloped and unfertilized eggs may be reabsorbed into the parent tissues and the ovary dwindles again until the new season again ripens the ova.

When the spermatozoon reaches the ovum its head pierces the envelope of the ovum and carries within it the chromosomes and the centrosome. The locomotor tail, having accomplished its purpose, is shed without as waste matter. The centrosome divides and becomes the centres of great protoplasmic activity, in other words become the stimulus to the growth of the embryo. The chromosomes, half of the male complement, unite with the present half of the female complement. The total is once more complete and the 'hereditary formula' (as I have called it to express in one both an idea and an entity) is fulfilled again ready to hand on through the next generation. Once a spermatozoon has entered an ovum, the outer surface of the ovum changes in character so that it becomes non-receptive to the entry of fresh spermatozoa. If this change is delayed, fresh spermatozoa may enter, and in some cases lead to the birth of monstrosities, by disturbing the work of the original centrosome.

We will now follow the history of the fertilized ovum. It burst from its capsule, we have seen, because of the pressure exerted by the continued accumulation of yolk and consequent increase in size. Occasionally the liberated egg may miss the oviduct and fall into the abdominal cavity. In that case it is usually reabsorbed by the peritoneal surfaces, though occasionally, and doubtless only if the bird is not in vigorous condition, a fatal disturbance is caused to the system. Normally however the egg is caught up by the trumpet-shaped mouth of the oviduct whose position with reference to the ovary generally ensures success.

In the oviduct the ovum or germ-cell becomes the egg as we know it. It is not necessary here to describe the oviduct or its processes in great detail. Suffice it to say that as the ovum passes slowly downwards, it is surrounded by various instalments of albumen (white of egg): it is surrounded by a shell-membrane and a calcareous shell; the shell is usually stained with pigments before it is finally set; and the manner of the deposition of these pigments, that is the markings of the perfect egg, afford some hint as to the order and time when they are laid on to the shell. The fact that the egg travels downwards with the broad end first explains why most eggs have the majority of their markings at that end and why a cap or a zone is so common a type of marking. Finally the perfect egg is expelled from the oviduct and through the vent and is henceforth separate from the body of the parent.

We are accustomed to attach a great deal of importance to the actual laying of the egg, and naturally so. At this point the egg appears in human ken. At this point it becomes of importance to the human being, whether as a matter of food or of interest. But strictly speaking, this stage is not of the same importance to the embryo itself. We have got to hold to the idea of one straight line of development starting with the maturation of the ovum in the oviduct and leading through an infinity of phases to the adult bird. The mysterious rhythm of life prepares the ovum ready for this line of development. The impetus to the start is furnished by the spermatozoon. Without it the matured ovum fades away again. With it the embryo unfolds like a plant from the seed. At the start it is housed in the ovary, then in the oviduct, then in the shelled egg, then in the nest; the final stages to maturity are passed as a complete bird. But we have to remember that the stage which is passed by the embryo in the shelled egg is no whit the more important to the embryo from the fact that its coffer then becomes, from utilitarian or æsthetic uses, of interest to the human being. To emphasize this, we have only to remember the case of the snakes and lizards. Some are oviparous and others viviparous, that is to say, the egg case may break within or without the body of the parent. Their whole clutch is often laid at one time, or at any rate in batches.

We attach a false importance to the egg, we are apt to consider it as the starting point of the embryo, for one very good reason. At this point nature usually applies the brake, and we witness the restarting.

Each egg is laid after an interval of 24 hours on the average. Occasionally the period is shorter. In some species the interval is 48 hours. The clutch of eggs is often quite large, say 12 or 14 eggs. The growth of a young bird is in its early stages particularly rapid. It is easy to see therefore that if each embryo continued its progress unbroken the safety of part of the brood would be greatly endangered. In cases of a large clutch—the long-tailed Tits of the genus *Ægithalus* for instance—some of the eggs would be still unhatched whilst the young from the earlier eggs would be almost ready to fly. The labour to the parents would be greatly increased and either the oldest or the youngest members of the brood would of certainty suffer and probably be lost.

Originally in the ancestral bird no doubt there was no halt in the development. The egg was laid in the herbage and rotting vegetation of the steaming primeval world and the incubation of the embryo proceeded unchecked by the transfer from the maternal body to the outer world. The same thing continues to-day, as we have seen, in the case of the Megapodes who immediately bury their egg deep in the mound of sand and vegetation and so retain its initial warmth.

The case of the Megapodes is however exceptional. The general rule is for the egg to be laid in the open and so experience a definite drop in temperature from the body heat of the mother. This drop in temperature retards the development of the embryo, just as all the functions of a hybernating butterfly or dormouse remain in abeyance during a fall in the temperature. If the drop is too low or too long the embryo must perish. A few families such as the Owls (*Strigidæ*) and the Herons and Bitterns (*Ardeidæ*) are accustomed to start to incubate with the laying of the first egg. The result is that in these cases there is no gap in the development of each embryo. The young in the nest are found in regular gradations of size, and their habits are such that no particular injury is inflicted on the broods, or trouble given to the parents by the different ages of the young. In these forms the character of the food and the comparative ease with which it is obtained, probably contributes to success.

The vast majority of birds, however, pay little attention to the nest or eggs until the clutch is complete. The newly-laid egg cools to the air-temperature. The embryo becomes torpid and all development is arrested. With the completion of the clutch the parent starts to incubate eggs in which the embryonic development has all been arrested at the same stage. The resulting nestlings all hatch about the same time, are of the same apparent age, and leave the nest about the same time. When they fledge and leave the vicinity of the nest, the parent is free to continue with them and often remains with them for a considerable period.

It may be of interest to describe the structure of the newly-laid egg (Fig. 3). Popularly we talk of the yolk, the white, the inner skin and the shell of an egg. These must be considered in greater detail.

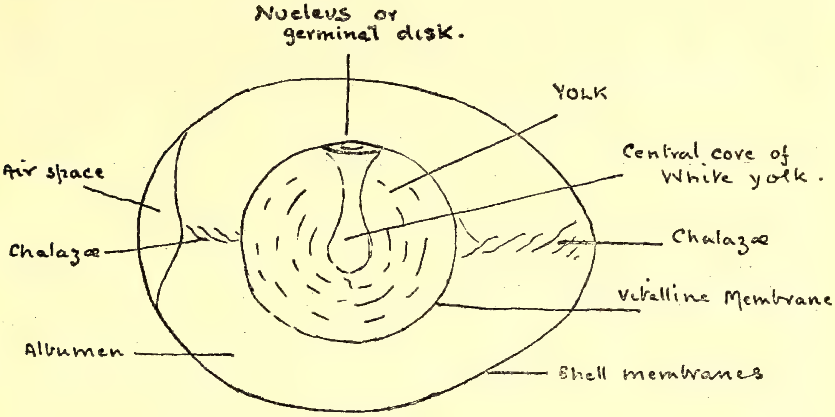

Fig. 1. Sketch of egg with shell removed.

The yolk consists of two different textures, known as 'white yolk' and 'yellow yolk' (though both of them are really yellow in colour). The white yolk contains a higher percentage of water. Reference to the figure will show that there is a central core of white yolk, funnel-shaped, and surrounded by yellow yolk in which there are alternating layers of the white yolk. On the top of the disk of the funnel core lies the nucleus or germinal disk of blastoderm out of which the embryo is to be developed. It is to be remarked that the yolk as a whole turns about within the egg so as to keep the germinal disk uppermost, whichever side the egg is lying on, so that it is nearest to the warmth of the incubating mother. This explains why the good poultry-keeper turns daily the eggs which are being kept for a setting, in order to insure that the yolk should retain its mobility against the time of need. The yolk with the germinal disk is contained within a vitelline membrane which is really the cell-wall of the original ovum dilated to contain the addition of the yolk which it received in the ovary.

The white or albumen is added in the oviduct. It consists of alternating dense and watery layers which give it a spiral arrangement. Some of the denser layers near the vitelline membrane extend as twisted cords (chalazœ) towards the two poles of the egg. They do not quite reach the outer layer of the white though the chord at the pointed end ultimately becomes somewhat superficially attached to the lining membrane of the shell. These chalazœ are elastic supports for the yolk and suspend it in position. The complete egg thus constituted is enclosed in the shell-membrane which consists of an inner and outer layer, both of which remain permanently in close apposition over the greater part of the egg and adhere to the shell. At the broad end they tend to separate and develop an air-chamber between them. This air-chamber does not exist in a perfectly fresh egg but is produced and increases as the bulk of albumen decreases by evaporation. This air-chamber explains why an incubated egg floats. The shell is finally deposited on the shell-membrane as a mamillary and porous layer, which in most species has also an outer cuticular layer. This outer layer is the most variable part of the shell and is responsible for the differences of texture which we find duly chronicled in all descriptions of eggs. It is apparently structureless ; if it is poor in calcine salts the egg is very smooth and shiny. If it is greatly infiltrated with calcareous matter we get the rough and chalky eggs of the cormorants (*Phalacrocorax*) and Grebes (*Podiceps*). In some forms it is entirely absent. This outer cuticle is spread over the entire surface of the egg, extending unbroken over and into the pits (or surface ends of the air-canals in the main shell) and therefore closing them. When dry, the cuticle is permeable by air, when wet, impermeable. The poultry-keeper who uses 'water-glass' to preserve his eggs is therefore merely keeping out the air by a sterilized layer of water and so arresting the ordinary process of decay.

The actual colour of the egg is produced by pigment-corpuscles,[1] which may be deposited in various levels of the shell. The pigments are deposited by the oviduct during the formation of the shell and cuticle and they may be deposited according to species in any or every strata. The colour in the innermost layer may not be visible until the blown shell is held up to the light. As the colour and pattern of the egg are deposited by secretions from the oviduct, it is not curious that there is distinct resemblance between the eggs of one clutch and the various clutches laid by an individual bird. The poorly-marked and pale egg so often found in a clutch is usually either the first egg (before the pigment secretions are fully working) or the last (when they are becoming exhausted).

I do not propose to discuss the varied colours of eggs in detail. These my readers can supply from their own experience. But it is well perhaps to emphasize a few general points. Firstly, there is no connection at all between the colour of a bird and of the egg which it lays. Secondly, there is very little taxonomic significance in the colours and patterns of eggs. We may attribute a certain type of egg to a particular family and then find that such a description might almost equally apply to the eggs of a totally different group.

I have already pointed out that it is probable that all eggs are derived from an original white or pigmentless egg similar to those laid by some reptiles to-day ; and I think it is correct to consider that with eggs and nestlings there is a great deal to be said for the theory of protective colouration. With eggs it would have had two active stimulants. First of all, as we have seen, a white egg is a most conspicuous object in the open and colouration and markings must undoubtedly tend to an increase of safety. Whilst at the same time we must remember that light in excess is inimical to protoplasm. Pigment in the shell must therefore also be of importance in protecting the germinal disk from direct light.

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[1] This subject has not yet been fully investigated and very little is really known about it.

It is customary to point to the fact that most hole-breeding species lay white eggs as proof that the original egg was white. It is certainly an indirect proof, but we must also remember that as much development has gone to the making of the highly glazed eggs of the Woodpeckers and Bee-eaters as to the protectively-coloured eggs of the Nightjars and Sandgrouse. In such cases the need has perhaps been conspicuousness, so that the parent bird entering the hole may readily distinguish the eggs and so avoid accidents.

There are a few points of interest.

Abnormal eggs are common and they are most usual in domesticated birds, especially fowls, where unsatisfactory conditions of food and environment or over-production of eggs and consequent strain affects the normal action of the oviduct. A ' soft-shelled ' egg is due usually to lack of sufficient calcareous matter. A dwarf egg is due to various causes. The ovum may have been liberated from the ovary prematurely and so have not received its proper allowance of yolk. There may be some pathological condition of the oviduct which means that the dwarf egg is its last product. In other cases a blob of albumen without an ovum, a blood clot or some foreign body passes through the oviduct stimulating its functions and resulting in the production of a miniature but functionless egg.

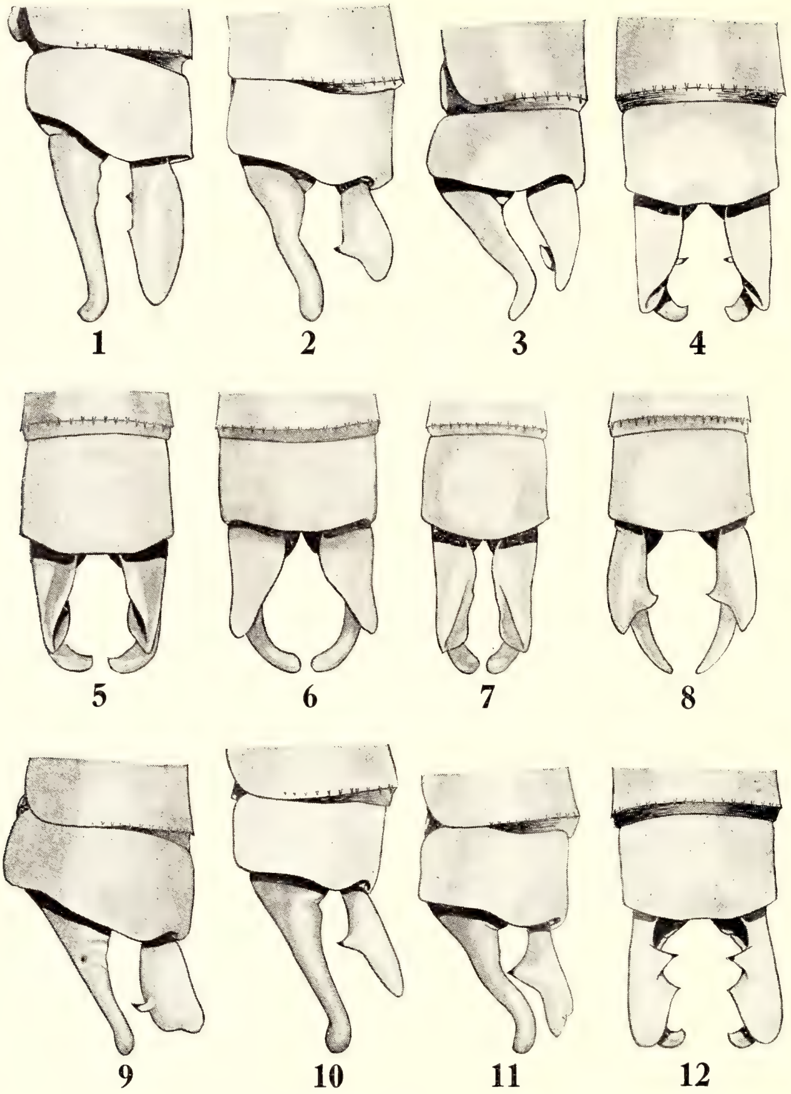
Double- and very rarely triple-yolked eggs occur. A double-yolked egg is due to the liberation of two ova into the oviduct from the ovary without the usual interval between. Different varieties of arrangement of such double-yolked eggs are due to the levels within the oviduct at which the ova coincide. Triple-yolked eggs are of course similarly caused. Twins are known to have hatched from double-yolked eggs.

We may remark here on the explanation of the increase in the comb of domesticated hens at the time of egg-laying, as a similar phenomenon must occur in many wild birds. The increase of the comb is due to a fatty infiltration of the central connective tissue core of the comb. When this fat is decreased, the comb again dwindles. At egg-laying periods the blood is charged with fatty material which provides the yolk for the ova. The excess of this is deposited in the comb and probably also has some connection with the change of colour of the soft parts of many species during the breeding season.

Mention must also be made of the unconscious power which many birds undoubtedly have of regulating the number of eggs laid. Not much is known about this but the common Wryneck (*Jynx torquilla*) which normally lays some 6 to 10 eggs has in England been induced to lay upwards of 40 eggs. This is done by the simple method of abstracting an egg from the nest daily during the laying period so that the clutch is never completed. These extra eggs would normally never have been laid. We believe that the converse also obtains, that eggs which normally would have been laid on a certain date are delayed or even suppressed when the destruction of the nest, abnormal weather or other circumstances render it desirable. The fact is certainly well-known to the poultry-farmer. Runner-ducks at the full height of daily laying immediately stop in response to some sudden change in their surroundings.

Connected with the egg is the so-called 'incubation patch' on the parent birds.

The incubation patch is a bare patch of skin, often of considerable extent, on the under surface of the incubating bird. It reaches its greatest development in the female but is also found to a lesser extent in those males which share the work of incubation. One is apt to think loosely that the patch is due to the attrition of the feathers from contact with the eggs or that they are plucked off by the parent. This however is not so. The patch often starts before the eggs are actually laid and it is due to a local moult which is induced by a physiological factor. This is a very definite transformation locally of the skin and blood vessels. The blood vessels increase whilst the skin becomes loose-meshed and watered from an absence of the fatty layer and an escape of the blood serum from the vessels into the tissues. The result is a local inflammation which concentrates body heat on the eggs. In most species the patch is a single large central one, but in the Waders there are two lateral patches. It is noteworthy that that aberrant Wader, the Crab-Plover (*Dromas ardeola*) has these two lateral patches although it only lays a single egg.



Explanation of Plate.

Anal appendages of

1. *Cocliccia fraseri* seen from the left side.
2. *Coeliccia poungyi*, same view.
3. *Coeliccia loogali*, same view.
4. *Coeliccia chromothorax*, dorsal view.
5. *Coeliccia loringæ*, dorsal view.
6. *Coeliccia renifera*, dorsal view.
7. *Coeliccia poungyi* dorsal view.
8. *Coeliccia loogali*, dorsal view.
9. *Coeliccia chromothorax*, seen from the left side.
10. *Coeliccia renifera*, seen from the left side.
11. *Coeliceia didyma*, seen from the left side.
12. *Coeliccia fraseri*, dorsal view.

INDIAN DRAGONFLIES

BY

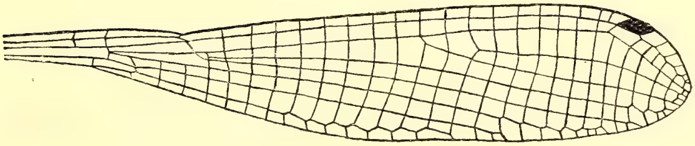
F. C. FRASER, LT.-COL., I.M.S., F.E.S.

Part XXXIX.

(*With 1 plate and 1 text-figure.*)

(*Continued from page 341 of Volume XXXV.*)

Sub-family: PLATYCNEMINAE.



Forewing of *Coeliccia membranipes* (Ramb) to illustrate the venation of the *Platycneminae.*

Dragonflies of small size, coloured black marked with blue or bright chrome yellow, or red or chrome yellow marked with black, or black marked with red, never metallic: resting with wings closed over dorsum; wings narrow, rounded at apices, always hyaline: the nervure *Ac* situated about midway between the levels of the two antenodal nervures or rather nearer the level of the distal one: no accessory basal postcostal nervures ever present: petiolation beginning at or slightly distad the level of *Ac*; the nervure *Ab* always present and continuous with the nervure *IA,* which latter extends to the middle or beyond the middle of wings; *Cuii* well developed and extending a short distance beyond the end of *IA*; discoidal cell variable but always elongate, the distal end slightly bevelled or squared, the costal side of discoidal cell shorter than or of the same length as the posterior; sectors of arc arising from lower end of arc, divergent from their origins; individual cells mostly four-sided; origin of *Riv + v* variable in the genera and species, either arising before, at or more or less distad the level of the oblique nervure descending from the node; pterostigma diamond-shaped, rather longer than broad, usually braced; no intercalated sectors present except *IRii.*

Abdomen of moderate length, slender or moderately robust, falling well short of twice the length of hindwing, the segments 8, 9, and 10 becoming progressively shorter in all genera and species; anal appendages of male showing great variation both in the genera and individual species, but very homogeneous in some of the genera such as *Coeliccia* and *Calicnemis.* Vulvar scales robust but not as conspicuous as in the *Platystictinæ*; penile organ very variable but usually with the end curling up over the stem and more or less branched at its termination.

Larvæ known of only a few species and very variable; breeding in streams or swamps and usually in heavy virgin jungle.

Distribution.—Throughout the tropics of the Old World, and, for at least one genus, the temperate zones of Europe and Asia. Within our limits, throughout India, Ceylon and Burma, usually in montane and submontane tracts, but all genera except *Copera* confined to N.-E. India and Burma. *Platycnemis* however occurs sparingly in the North and North-west of India. Five genera occur within our limits.

Key to the Indian genera of *Platycneminae*.

1.	Costal side of discoidal cell at least one-fifth shorter than the posterior, usually more than this ...	2.
	Costal and posterior sides of discoidal cell nearly equal in length	*Copera*.
2.	The nervure *Ab* arising at the level of *Ac* ...	*Coeliccia*.
	The nervure *Ab* arising proximad of the level of *Ac*.	3.
3.	Four cells between the discoidal cell and the oblique nervure descending from the node	*Indocnemis*.
	Three cells between the discoidal cell and the oblique nervure descending from the node	*Calicnemis*.
	Only two cells between the discoidal cell and the oblique nervure descending from the node ...	*Platycnemis*.

Genus COELICCIA Kirby (1890).

Trichocnemis Selys, Sagra, Hist, Cuba, Ins. p. 464 (1857); Id. Bull. Acad. Belg. (2) xvi. p. 155 (1863); Id. Mem. Cour. xxxviii p. 114, (1886); Laid. Fascic. Malay. (*Odonata*) Part ii, pp. 2–7 (1907).

Coeliccia Kirby, Cat. Odon. p. 128 (1890); Laid. Rec. Ind. Mus. vol. xiii, pp. 322,325,331–333 (1916); Ris. Suppl. Ent. No. 1. pp. 60–62, (1912).

Zygopterous dragonflies of medium size and slender build with abdomen less than twice the length of hindwings; coloured black marked with blue, yellow or bright chrome yellow. Wings hyaline, moderately narrow, rounded at apices, never falcate, with a moderately long petiole; discoidal cell elongate, costal side about four-fifths or slightly less than four-fifths the length of posterior side, distal side at least half as long again as basal and very oblique so that the cell is acutely pointed at its lower distal angle; sectors of arc slightly separate at origin, arising from lower end of arc, divergent from origin; no accessory basal postcostal nervure present; the nervure *Ac* situated at a level slightly nearer the distal antenodal nervure; *Ab* always present and complete, continued on as *IA*, which latter extends for nearly three-fourths the length of wings; petiolation beginning slightly proximal to *Ac*; *Cuii* extending a short distance beyond the end of *IA*, 20 cells or more in length; *Riv + v* arising a little proximal to level of node, *IRiii* a little distad but the position of these two latter very variable in species; pterostigma small, its sides nearly equal, oblique and diamond-shaped, poorly braced; cells of wings mainly quadrangular; 2 or 3 cells between the discoidal cell and nervure descending from the node.

Head narrow; eyes smaller than in species of *Platysticta*; occiput simple; prothorax with the posterior lobe rounded and simple in the male, notched or armed with elongate spines in the female; abdomen cylindrical, slim, broadened at extreme base and gradually broadening from segment 7 to the end, about one-third longer than the wings; anal appendages variable in the species but inclined to be rather homogeneous, superiors usually broad at base, acute at apex and furnished with an inner subapical spine, inferiors longer than superiors, broad at base, abruptly tapered and subcylindrical, slightly sinuous, subacute or acute at apex. Genitalia.—lamina narrowly but deeply cleft; hamules broad quadrate plates meeting broadly across the genital pit; penis with apical end curling strongly over stem of organ and with the end variable, deeply cleft, bifid or branched; lobe pyriform, short, with a shallow longitudinal groove running its whole length; vulvar scales robust, stout, extending slightly beyond end of abdomen.

Distribution.—N.E. India, Burma, Malaysia, Indo-China, Formosa, Philippines, Sondaic Archipelago and Borneo. Only nine species found within Indian limits, of which five occur in Assam, and the others in Burma. Genotype.—*C. membranipes* (Ramb.).

Laidlaw has divided the genus up into three groups according to the relative positions of *Riv + v* and *IRiii* to the subnode. In the 1st group, *IRiii* arises at the subnode, *Riv + v* proximal to it; in the 2nd, *IRiii* arises distal and *Riv + v* proximal to it; in the 3rd, *IRiii* arises distal to the subnode and *Riv + v* from it. Most Indian species belong to the first and second groups.

Key to Indian species of genus *Coeliccia*.

1.	Dorsum of thorax wholly blue	*C. poungyi* Fras.
	Dorsum of thorax wholly golden yellow ...	*C. chromothorax* (Selys).
	Dorsum of thorax with a single pair of oval pale blue spots	*C. bimaculata* Laid.
	Dorsum of thorax with two pairs of pale blue spots	2.
	Dorsum of thorax with a pair of antehumeral stripes	3.
	Dorsum of thorax pale blue for the lower half ...	*C. renifera* (Selys).
2.	Lower pair of spots simple, pyriform ; segment 10 and the basal two-thirds of segment 9 pale blue	*C. didyma* (Selys).
	Lower pair of spots broad and branching into two above ; segment 10 blue marked broadly with black at apical border ; segment 9 wholly blue ; segment 8 with its apical half blue	*C. loringae* Laid.
3.	Antehumeral stripes lying nearer the humeral suture than middorsal carina	4.
	Antehumeral stripes lying closely opposed to the middorsal carina	*C. fraseri* Laid.
4.	Posterior lobe of prothorax of female simple ...	*C. loogali* Laid.
	Posterior lobe of prothorax of female prolonged and deeply and broadly notched, the corners of the notch prolonged into long recurved horns as seen in profile	*C. vacca* Laid.

Coeliccia bimaculata Laid.

Coeliccia bimaculata Laid. Rec. Ind. Mus. vol. viii, p. 341, pl. xvi, fig. 1 (1914) ; Id. ibid. vol. xiii, pp. 335, 336 (1917) ; Id. MS (1931).

Male. Abdomen 36 mm. Hindwing 22 mm.

Head,—labium pale yellow ; labrum black ; anteclypeus, genæ and the bases of mandibles partly blue ; postclypeus, frons and vertex black, the latter traversed at the level of ocelli by a broken pale blue stripe ; occiput with pale yellowish pyriform postocular spots.

Prothorax black, the sides palest blue or creamy white.

Thorax black on dorsum, palest blue laterally, the former with a pair of oval pale blue spots lying in close apposition to the anterior half of the middorsal carina ; a narrow oblique black stripe on each side bordering the mesepimeron anteriorly ; beneath creamy white.

Legs palest yellow, femora with two black stripes, tibiæ black on flexor surface only, joints and ciliæ black.

Wings hyaline ; pterostigma blackish brown framed palely in brown, its proximal border very oblique, covering 1 cell ; *Riv + v* arising proximal to the subnode, *1Riii* at the subnode ; 18 to 20 postnodal nervures in forewings, 17 to 18 in the hind.

Abdomen dark reddish brown on dorsum deepening to black at apical end of segments and on dorsum of segment 2 and segments 7 to 10. All segments pale yellow laterally, this colour extending dorsalwards on 3 to 6 so as to form paired spots.

Anal appendages creamy white ; superiors triangular as seen from above, deeply excavated within, the inner border ending in a minute black point. Inferiors slightly longer than superiors which are themselves slightly longer than segment 10, slender, curling in at apices forcipate-like and also ending in a minute black point at apex.

Penis with a prominent terminal lobe, the apex bifid and ending in a pair of long whip-like processes.

Female. Abdomen 35 mm. Hindwing 23 mm.

Very similar to the male but the blue replaced by creamy white except the facial markings and lower half of eyes which are blue. Prothorax with black posterior and anterior lobes, these two areas confluent by a fine middorsal black line on middle lobe ; posterior lobe with the middle of hinder border prolonged into a small tongue-like process on either side of which is a minute lobe. (This lobe evenly convex along the hinder border in the male.)

Dorsal thoracic markings narrow stripes lying close to middorsal carina and prolonged and narrowing as far as the antealar sinus very much as in *C. fraseri*. Segment 8 of abdomen with its apical two-thirds palest yellow, or, in tenerals, segments 8 to 10 entirely creamy white. Anal appendages and vulvar scales pale yellow.

Distribution.—Several males and females from Tura, Garo Hills, Assam. Type, an incomplete male in the Indian Museum, taken at an altitude of 1,500 ft. June and July. Distinguished from other species by the two oval spots on thoracic dorsum and by the pale undersurface of thorax.

Coeliccia vacca Laid Rec. Ind. Mus. MSS. (1931).

Female. (Male unknown) Abdomen 36 mm. Hindwing 25 mm.

Head,—labium pale yellow, labrum black, anteclypeus, genæ and bases of mandibles pale blue, rest of head black with a chain of four small spots across the ocellar space and a pyriform postocular spot on each side of occiput, eyes black above, greenish for the lower half.

Prothorax with anterior and posterior lobes black, this dark area connected by a broad median black stripe on middle lobe, the sides pale blue or yellowish, posterior lobe prolonged back as a quadrate lobe, deeply and broadly notched, the angles of the notch prolonged as two horns which are angulated strongly forward, and, in profile, are shaped like the horns of an ox.

Thorax black on dorsum, pale blue laterally and beneath, the dorsum marked with a narrow pale blue antehumeral stripe on each side which lies nearer the humeral suture than the middorsal carina; on each side a narrow oblique black stripe incomplete below, bordering metepimeron.

Legs creamy white, extensor surfaces of femora, the lower or distal half of anterior femora on flexor surface and the flexor surface of tibiæ black.

Wings hyaline, pterostigma black-bordered finely along costal border with white, covering 1 cell, braced, 19 postnodal nervures in forewings, 17 in the hind; *Riv + v* arising at subnode, *IRiii* well after it.

Abdomen blackish brown on dorsum, yellowish laterally, the sides of segment 8 broadly yellow, this colour extending up on to dorsum to meet above and form a narrow apical annule; basal half of segment 9 also yellow. Anal appendages black, conical, short, vulvar scale black, robust.

Distribution.—Tura, Garo Hills, Assam. Only a single specimen of this curious insect is known, the type, a female in the Indian Museum. Distinguished from all other species by the unique development of the posterior lobe of prothorax.

Coeliccia renifera (Selys) (1886)

Trichocnemis renifera Selys, Mem. Cour. xxxviii, p. 119 (1886), Laid, Fasc. *Malay.* (*Odonata*) part ii, p. 2 (1907).

Trichocnemis didyma Selys, (*C. renifera* nec *T. didyma*) Mem. Cour. xxxviii, pp. 118-119 (1886).

Coeliccia renifera Kirby, *Cat. Odon.* p. 128 (1890), Laid. Rec. Ind. Mus. vol. xiii, pp. 322, 332, 333 (1917), Fras. *Journ. Bom. Nat. Hist. Soc.*, vol. xxix, p. 744 (1923).

Male. Abdomen 33-47 mm. Hindwing 22-28 mm.

Head,—labium pale brown tipped with black, labrum and bases of mandibles steely blue-black, anteclypeus and genæ pale sky-blue, postclypeus glossy black, vertex, occiput and beneath head velvety black, the former marked with obscure small triangular spots, one between each outer ocellus and the base of antennæ; a well-defined pale yellow transversely oval spot on each side of back of occiput, and a small yellow spot beneath head against the eyes, the latter olive green below, black at summit.

Prothorax velvety black, unmarked; posterior lobe rounded, simple.

Thorax velvety black marked with pale blue or pale greenish yellow—a broad oval-oblong spot on each side the middorsal carina extending about halfway up the dorsum, narrowly separated from each other by the black carinal ridge; each side broadly coloured, the anterior two-thirds of the mesepimeron except the part just beneath the roots of wings, and the whole of the metepimeron, the whole area narrowly divided by the postero-lateral suture which is finely black. Beneath entirely black.

Legs black on extensor surfaces of femora, and flexor surfaces of tibiæ, opposite surfaces of these pale carneous or creamy white ; coxæ and trochanters yellow anteriorly, black behind.

Wings hyaline ; pterostigma black, finely framed in pale brown and thick black nervures, braced, covering about 1 cell ; 18 to 20 postnodal nervures in forewings, 16 to 18 in the hind ; *Riv+v* arising a short distance proximad to the subnode (or in Simla specimens, at the node or a shade before it, and sometimes in conjunction with *IRiii*), the latter arising at the subnode or a shade distad to it.

Abdomen black, yellow beneath ; segment 1 with a small lateral pale yellow spot ; segment 2 with its ventral border broadly pale blue or yellow (according to age) ; segments 3 to 6 with elongate subapical lateral creamy white or pale bluish spots, remaining segments unmarked.

Anal appendages creamy white, superiors beneath, and inferiors at base brownish black ; superiors about as long as segment 10, conical and rather obtuse at apex as seen from above, cigar-shaped as seen from the side and with a small median black ventral spine ; inferiors one-third as long again as superiors, broad at base, then cylindrical and curled gently in, their apices nearly meeting at the midline, sloping strongly up as seen from the side, apex obtusely rounded. Penis much broadened anteriorly and shallowly concave, the apical portion curling strongly over, presenting a small dorsal spine within the curve, and a small lappet-like lobe on either side just before the apex bifurcates into short branches which turn directly out at right angles to the body and end obtusely.

Female. Abdomen 42–46 mm. Hindwing 29–33 mm.

Differs in several respects from the male, the blue markings only present in very adult specimens, and usually creamy yellow.

Head similar to the male in most respects, differing as follows,—the pale markings of face pale greenish blue ; the small triangular spot on vertex replaced by a chain of six spots, one in the same situation as that of male and connected narrowly with a second which extends out to the eye, lastly a third rounded spot lying between the outer and medial ocelli on each side ; the spot on the under side of head against the eyes very much larger and broadly triangular.

Prothorax citron yellow with the whole of anterior lobe black, the middorsal ridge rather broadly and the hinder border ; the posterior lobe vestigial, only a lateral rudimentary process on each side.

Thorax black on dorsum nearly as far lateral as the anterolateral sinus and marked with a pair of antehumeral narrow complete bluish green stripes ; laterally pale blue, or yellow in subadults or tenerals, marked with a very fine line on the postero-lateral suture ; beneath pale blue or yellow, unmarked.

Legs yellow, all tibiæ black on flexor surface ; anterior pair of femora with a black stripe on front and back, confluent at distal end of limb ; hinder two pairs with this marking much restricted, especially on the hind pair.

Wings as for male, palely enfumed in adults ; 20–21 postnodal nervures in forewings, 18–19 in the hind ; pterostigma with the pale brown frame much more in evidence ; *Riv+v* more proximad the subnode, and *IRiii* always arising distad of that nervure.

Abdomen blackish brown, black towards the end segments, marked beneath and laterally, broadly with greenish blue changing to yellow on the end segments, and laterally and subapically expanding into largish spots ; segment 8 with a broad apical yellow or bluish-green annule covering nearly half the segment ; segment 9 nearly entirely pale blue or bluish-green, its base narrowly, and the sides broadly black, the black of base prolonged apicad as two submedian points. Occasionally the yellow annule on 8 narrowly interrupted on the middorsal carina ; segment 10 brownish black, unmarked.

Anal appendages shorter than segment 10, conical, pointed, black ; vulvar scales projecting beyond end of abdomen, very robust, bright yellow.

Distribution.— Upper Assam and Bengal, Sikkim and Simla States. The author has specimens from Darjeeling, Bengal, collected in July ; from Pashoke, British Sikkim, collected in May, and from Gopaldhara, Assam, collected in September. Also some specimens from Barog, Simla Hills, 5,000 ft. collected in August, these latter being very small and evidently similar to the specimen described by Selys as from Darjeeling, and determined in error as *C. didyma*. The single thoracic dorsal marking and the black underneath of thorax are in themselves sufficient to distinguish the insect from *C. didyma* which has two spots and a pale blue underside to thorax. These small Simla specimens do not differ in the slightest, except for size, from the larger forms from elsewhere. The single blue dorsal spot restricted to the lower half of the thorax will serve to determine this insect.

Coeliccia didyma (Selys) (1863).

Trichocnemis didyma Selys. Bull. Acad. Belg. (2) xvi, p. 155 (1863) ; Id. (*C. renifera* nec *didyma* Mem. Cour. xxxviii, p. 118 (1886).

Coeliccia didyma Kirby, Cat. Odon. p. 128 (1890) ; Laid. Rec. Ind. Mus. vol. xiii, pp. 322, 332 and 335 (1917) ; Fras. *Journ. Bom. Nat. Hist. Soc.*, vol. xxix, p. 745 (1923) ; Laid Rec. Ind. Mus. MS. (1931).

Male. Abdomen 40 mm. Hindwing 26 mm.

Head labium yellow ; labrum and postclypeus steely blue-black, bases of mandibles, genæ and anteclypeus pale sky blue, the former narrowly black at base ; vertex and occiput velvety black, the former with a small triangular blue spot on each side lying between the ocelli and antennæ, the latter with a pyriform elongate pale yellow spot on each side ; beneath head broadly pale blue ; eyes olive green below, black above.

Prothorax black with a large pale blue spot on each side the middle lobe and the lower border narrowly ; posterior lobe simple rounded.

Thorax velvety black on dorsum marked with two pyriform elongate antehumeral spots on each side the middorsal carina, a lower larger spot extending nearly halfway up the dorsum, pointed above, and an upper smaller spot extending from the antealar sinus for about one-fourth the length of dorsum and pointed below; laterally pale blue, the postero-lateral suture broadly mapped out in black ; beneath palest blue, unmarked.

Wings hyaline ; pterostigma blackish framed finely in pale brown and thick black nervures, braced, covering one and a half cells ; 18 postnodal nervures in forewings, 17 in the hind ; *Riv+v* arising a short distance proximad the subnode, and *IRiii* a similar distance distad that structure ; *Ab*, especially in the forewings, arising a short distance distad the level of *Ac*.

Legs yellow, femora with a black stripe running the whole length of extensor and flexor surfaces, more extensive on the former, where it is continued on to the trochanters and coxæ ; tibiæ black on flexor surface.

Abdomen black on dorsum and sides, pale yellow beneath, the sides of segment 1 broadly yellow, the lower part of sides of segment 2 narrowly so ; a linear longitudinal streak of yellow on dorsum of the latter segment, not quite extending to apical border ; segments 3 to 6 with small paired pale blue basodorsal spots ; segments 7 and 8 entirely black save for a narrow border bluish on the latter near the ventral surface ; segments 9 and 10 pale blue, but the basal third of former with a broad annule of black.

Anal appendages livid or pale yellow, the base of superiors and the apices of inferiors blackish ; superiors slightly longer than segment 10, conical and hollowed out within as seen from the dorsum, narrow at base, with a broad ventral tooth, tipped with black, and the obtuse apex with a shallow dorsal notch as seen from the side ; in semi-profile view, a fine black spine seen near the base within ; inferiors slightly longer than superiors, very sinuous as seen from the side, the apex obtuse, rounded and curled slightly down and markedly in.

Female unknown.

Distribution.—Described from a specimen from Kedah Peak, Simla States, 3,800 ft. taken by Capt. Cardew, 29-3-1928. The type, in the Selysian collection is an incomplete male, with end of abdomen missing, locality Thibet. Subsequently Selys described a small form of C. *renifera*, from Darjeeling, as a male of this species, giving the supposed and completed description of *C. didyma*. The female still remains to be discovered. The species is easily distinguished from all others by the two pyriform dorsal thoracic spots, pale blue in colour. *C. loringæ* which is very closely related to it differs by the lower of the two dorsal spots being broader and deeply bifid along its upper border and also by the blue markings of abdomen extending well onto segment 8, instead of restricted to the apical half of 9 and segment 10.

Coeliccia loringae Laidlaw (1931).

Cœliccia loringæ Laid., Rec. Ind. Mus. MS (1931).

Male. Abdomen 42 mm. Hindwing 27 mm.

Head,–labium white : labrum and postclypeus glossy black : bases of mandibles, genæ and lateral part of frons and the anteclypeus pale sky-blue ; rest of head velvety black with a small oval spot obscurely blue on each side of vertex between the lateral ocelli and bases of antennæ, and an elongate pyriform postocular spot pale yellow on each side of occiput ; beneath black, eyes bordered irregularly with pale blue ; eyes olivaceous beneath and at sides, black above.

Prothorax velvety black with a broad border on each side confluent with an elongate spot on the side of middle lobe, pale sky-blue : posterior lobe simple, rounded.

Thorax velvety black on dorsum where are seen two large pale sky-blue spots on each side, a smaller upper spot near the antealar sinus and upper part of humeral suture, extending slightly less than one-third the length of dorsum, and a large broad lower spot extending for the lower two-thirds of dorsum, bordering the middorsal carina inwardly and with a tongue-like projection on the outer side near the humeral suture, giving a bifid appearance to the spot : laterally pale sky-blue with the postero-lateral suture narrowly outlined in black ; beneath palest blue.

Legs white, extensor surfaces of all femora black, as also the distal end of the flexor surface of hind pair ; tibiæ black on the flexor surface ; tarsi entirely black.

Wings hyaline ; pterostigma blackish brown, paler at margins, covering one to one and a half cells, strongly braced ; 19 to 20 postnodal cells to forewings, 19 in the hind ; *Riv + v* and *IRiii* arising together from the subnode, or *IRiii* slightly distad that nervure ; rarely *Riv + v* a shade proximad to the subnode.

Abdomen black marked with pale sky-blue as follows : segment 1 broadly blue at the sides and more narrowly so at apex, the black dorsal spot just reaching that border at a point ; segment 2 broadly blue at the sides, and with a narrow middorsal stripe extending for three-fourths the length of middorsal carina ; segment 3 with a narrow basal annule narrowly interrupted on the middorsum, and a very broad subapical annule also narrowly interrupted on the middorsal carina ; this annule confluent with the blue of sides and beneath ; segments 4 to 6 very similar but the basal annules reduced to two small basal spots which are gradually reduced in size towards segment 6 ; segment 7 similar but the basal spots absent ; segment 8 with a broad blue apical annule resting on apical border and covering about the apical half of segment, more so subdorsally ; segment 9 entirely blue, whilst 10 is blue with a large trilobed black spot on apical border, the middle lobe of spot extending to base of segment.

Anal appendages pale creamy yellow, exactly similar in shape to those of *C. didyma*, except for the basal spine of superiors which is absent. Penis similar in shape to that of *C. didyma*, apex very broad and a little sinuous, very shallowly excavate, curling up over stem of organ and deeply cleft into two long slim branches which curl down and forwards and, at the extreme apices, again backwards. A strong dorsal spine within the curling arch of apex.

Female. Abdomen 41 mm. Hindwing 27 mm.

Differs in several respects from the male ; labrum bright ochre, its base narrowly black ; postclypeus black with a rounded yellow spot on each side ; bases of mandibles and genæ bright yellow ; the isolated spots on vertex replaced by a complete transverse stripe or with a slight interruption at the middle of head, this stripe very sinuous and traversing vertex between the ocelli ; elongate spots behind eyes bright yellow ; bordering of eyes beneath yellow.

Prothorax black, broadly yellow at the sides and beneath, posterior lobe reduced to a small median tongue-like projection directed straight back.

Thorax black marked with bright yellow as follows,—a very narrow ante, humeral stripe on each side of dorsum and a tiny upper humeral spot ; the sides and beneath all yellow save for a narrow black oblique stripe mapping out the postero-lateral suture.

Legs yellow, marked similarly to the male but tibiæ are entirely yellow, as also the trochanters and coxæ ; tarsi black.

Wings similar to the male in most respects ; pterostigma reddish brown between black nervures ; 19 to 20 postnodal nervures in forewings, 17 in the hind ; *Riv+v* slightly proximad the subnode ; *IRiii* at a greater distance distad, but the two arising very close together as in the male

Abdomen black with a bright yellow stripe running the whole length of sides ; segment 3 with a pair of basal subdorsal spots confluent with this yellow stripe ; segment 1 broadly yellow, its dorsum with a broad triangular black spot which reaches apical border at a point only ; segments 2 to 6 with the middorsal carina finely yellow ; segment 8 with nearly its apical half bright ochreous but a small apical dorsal triangle of black with its apex bifid and directed basad ; segments 9 and 10 wholly bright ochreous.

Anal appendages short, conical, pointed, bright ochreous as well as a conical protuberance beneath and between them. Vulvar scales ochreous, extending to end of abdomen.

Distribution.—Upper Burma. The type, in the author's collection, is from Gokteik, Upper Shan States ; other specimens were taken at Maymyo, Upper Shan States, Burma, during June and July. The species is only to be confounded with *C. didyma* from which however it is easily distinguished by the shape of the lower dorsal thoracic spot, by the conspicuous subapical blue annules on abdomen and by the blue markings at end of abdomen extending onto segment 8 as well as the whole of segment 9. The origins of *Riv+v* and *IRiii* are also different and the nodal index is higher.

Coeliccia loogali Laidlaw (1931).

Coeliccia loogali Laid., Rec. Ind. Mus. MS. (1931).

Male. Abdomen 42–43 mm. Hindwing 28 mm.

Head,—labium pale yellow ; labrum and postclypeus glossy black, the latter with a small spot at each side pale sky-blue ; bases of mandibles, genæ and outer part of frons pale sky-blue ; rest of head black, the vertex with an obscure triangular spot on each side lying between base of antennæ and outer ocelli, the occiput with a transversely elongate spot on each side behind eyes ; beneath black broadly pale sky-blue against the eyes ; eyes dark olivaceous green at sides and beneath, black above.

Prothorax black with a broad pale sky-blue stripe on each side below ; posterior lobe simple, rounded.

Thorax velvety black on dorsum to well beyond level of humeral suture, marked with a pair of antehumeral pale sky-blue narrow curved stripes with the convexity facing outwards and extending the whole length of dorsum ; a small upper humeral spot of the same colour, occasionally quite large, sometimes obsolete ; laterally pale sky-blue with a small black spot on the upper end of the postero-lateral suture and a similar spot below ; beneath pale sky-blue.

Wings hyaline ; pterostigma blackish grey, in a lighter frame and thick black nervures, braced, covering one and a half cells ; *Riv+v* arising well proximad of the subnode, *IRiii* slightly after that structure or occasionally opposite it ; 19 to 23 postnodal nervures to forewings, 18 to 19 in the hind.

Legs pale yellow as well as trochanters and coxæ, femora lined with black on extensor surfaces, tibiæ black on flexor, tarsi black.

Abdomen black on dorsum, pale blue to yellow on lower part of sides of segments 3 to 6, segment 1 broadly blue on the sides, segment 2 more so than on the following segments ; remainder black.

Anal appendages deep black as for abdomen, the superiors tipped with bright yellow at apex and another spot of yellow on apex of ventral spine ; seen from above, conical with an inner ventral subapical robust spine, giving a bifid appearance to the apex of appendage, on either side of which groove is seen the strongly contrasted small yellow spots ; inferiors one-fourth longer than superiors which are about as long as segment 10, tapered, very sinuous and with apical end turned strongly inward and down. Penis broadly dilated at apex and rather deeply notched at centre, the end curling strongly over stem of organ and ending in two broad lobes which embrace the stem closely on either side.

Female. Abdomen 40-41 mm. Hindwing 28 mm.

Differs in but few respects from the male, much less so than in other species of the genus. The labrum broadly bordered with yellow in all but very old specimens ; the outer spots on the postclypeus yellow and very small or almost obsolete in adult specimens ; the blue of genæ extending inwards across frons to a greater degree ; a narrow zig-zag transverse stripe across vertex made up of six small blue spots behind the antennæ and linking up the ocelli in a chain ; blue beneath head more extensive ; prothorax and thorax as for male but the posterior lobe of former reduced to a tiny median point and a small outer isolated lobe ; wings entirely similar to the male but palely enfumed in adults. Abdomen similar to the male except the terminal three segments,—segment 8 with a broad apical annule yellow covering slightly more than one-third the length of segment and confluent below with a yellow border ; segment 9 dark reddish brown with the apical border yellow or ochreous gradually vignetted off into the darker colour ; segment 10 very short, black.

Anal appendages black, conical, rather shorter than segment 10 ; vulvar scales robust, yellow tipped with black beneath, extending a little beyond end of abdomen.

Distribution.—Maymyo, Upper Shan States, Burma, during June and July. A number of males and three females in the author's collection. Type and paratype to be deposited in the British Museum collection. The species is easily distinguished from others by the curved blue antehumeral stripes on dorsum of thorax, by the lateral blue spots on postclypeus, by the very black abdomen of male, almost unmarked, especially the terminal segments, and by the black anal appendages tipped with two small bright yellow spots. The female is determined by the lateral spots on postclypeus and the broad terminal yellow rings on segments 8 and 9 followed by a black unmarked segment 10.

Coeliccia poungyi Fraser.

Coeliccia poungyi Fraser, *Journ. Bom. Nat. Hist. Soc.* vol. xxx pp. 52 and 53 (1926).

Male. Abdomen 43-40 mm. Hindwing 23-25 mm.

Head,—labium black, white at base ; labrum, bases of mandibles and lower half of genæ, ante- and post-clypeus glossy black ; upper half of genæ palest blue, this colour encroaching slightly on frons, which is black ; vertex and occiput matt black, the former with two oval spots with their bases on the posterior ocelli and apex directed towards the bases of antennæ, the latter with an elongate pyriform creamy yellow spot ; beneath head black, narrowly bluish against the eyes ; eyes black above, olivaceous green at sides and below.

Prothorax velvety black, the lower part of sides pale blue ; posterior lobe rounded, simple.

Thorax velvety black in the humeral area, pale sky-blue on dorsum and laterally from about the middle of mesepimeron. Dorsum almost entirely blue, the middorsal carina finely black, as also the antealar sinus above, and the small triangular area below in which the carinal ridge ends ; a small upper humeral spot sometimes present ; laterally the postero-lateral suture heavily mapped out in black ; beneath palest blue.

Legs black ; coxæ and trochanters posteriorly pale blue.

Wings hyaline ; pterostigma black or very dark brown, covering 1 cell, braced ; 17-18 postnodal nervures in forewings, 16 in the hind ; *Riv+v* and *IRiii* often arising very close together, the former usually very slightly before the subnode but occasionally at its level, the latter generally slightly after or rarely at its level.

Abdomen black ; segment 1 with the apical half of its sides pale blue, extending up along the apical border and nearly confluent over dorsum ; segment 2 with a narrow longitudinal stripe on each side at the ventral border, also a narrow linear stripe along the middorsal carina, the latter pale creamy white ; segment 3 with a pair of small subdorsal bluish spots at base and its middorsal carina finely yellow, this latter continued for a short distance on to segment 4 ; segments 9 and 10 bright chrome yellow.

Anal appendages bright yellow; superiors as long as segment 10, narrow at base, broadening at middle and again slightly tapered to apex which is bluntly conical, a small black-tipped ventral spine just beyond the middle and a smaller short spine near the base, which is seen with difficulty; inferiors one-third longer than superiors, broad at base, then ungulate and very sinuous, blunt and rounded at apices which are curved slightly inwards. Penis differing broadly from that of other species, very broad at apex which is a little sinuous, the end curling over strongly and ending in three processes, a median tongue-shaped lobe directed straight back over stem of organ, and two very thin, long, greatly curled branches, which curve down like a watch-spring on each side of the organ.

Female. Abdomen 40 mm. Hindwing 26 mm.

Differs rather broadly from the male, the blue markings replaced by bright ochre. Labium yellow; labrum bright yellow with two large black basal spot, narrowly joined across the middle; bases of mandibles, genæ and a large spot on each side of postclypeus bright ocherous; the oval spots on vertex replaced by a continuous transverse and very sinuous bright yellow stripe traversing the vertex between the ocelli; elongate spots behind eyes bright yellow, beneath eyes almost entirely bluish green.

Prothorax black, broadly yellow on the sides; posterior lobe almost obsolete, a mere median vestige present.

Thorax black on dorsum to nearly as far as the antero-lateral suture, marked with a narrow bright yellow antehumeral stripe on each side of dorsum; laterally and beneath yellow with a short vestige of a narrow black stripe on the upper part of postero-lateral suture.

Legs yellow, posterior surfaces of femora and anterior of tibiæ black; tarsi black.

Wings hyaline, pterostigma brownish black at centre framed in pale yellow and thick black nervures; 19 postnodal nervures to forewings, 17 in the hind; *Riv+v* arising widely proximad the subnode, *1Riii* in continuation of the nervure descending from it or occasionally very slightly distad of it.

Abdomen black with a broad yellow stripe extending along its whole length, more extensively so on segment 1; segment 8 with rather more than its apical third bright ochreous, whilst segments 9 and 10 are entirely of this colour. Anal appendages short, conical, pointed, yellow, as also a conical protuberance beneath and between them.

Distribution.—Upper Shan States, Burma. The type, a male in the British Museum, is from Maymyo, paratype female and males in the author's collection were taken during June and July.

The species is determined from others by the whole of dorsum of thorax pale sky-blue, whilst the female differs by the whole of the under-surface of eyes pale greenish blue and segments 8 to 10 yellow, rather less than the basal two-thirds of the former black, the apical border unmarked.

Coeliccia chromothorax (Selys) (1891).

Calicnemis chromothorax Selys, Ann. Mus. Civ. Genov. (2) x, pp. 70–71 (1891); Laid; Rec. Ind. Mus. vol. xiii, p. 327 (1917); Fras., *Journ. Bom. Nat. Hist. Soc.*, vol. xxix, p. 74 (1923).

Coeliccia chromothorax Laid., Rec. Ind. Mus. MS. (1931).

Male. Abdomen 42–43 mm. Hindwing 26–29 mm.

Head,—labium yellow tipped with black; labrum, bases of mandibles, genæ, clypeus, vertex and occiput black, the vertex with a small oval yellow spot lying between the posterior ocelli and antennæ on each side, the occiput with an elongate transverse pale yellow stripe on each side of occiput behind eyes, and a small point of yellow against the eyes beneath; eyes black on top, olivaceous laterally and beneath.

Prothorax black, sides of middle and anterior lobes broadly yellow; posterior lobe rounded, simple.

Thorax bright sulphur yellow on dorsum, the middorsal carina finely black, as also the antealar sinus and the small triangular area below at end of carinal ridge; the humeral area broadly velvety black as far as the antero-lateral suture, and with a small yellow point above just behind the upper end of humeral suture; laterally and beneath pale yellow with a narrow black stripe mapping out the postero-lateral suture, but incomplete below.

Legs yellow with extensor surfaces of femora, and flexor surfaces of tibiæ black, as well as tarsi.

Wings hyaline, palely enfumed in adults; pterostigma black very finely framed in yellow, covering rather less than 2 cells, braced; *Riv+v* very variable in origin, often fused with *IRiii*, or arising well before, slightly before or at the level of subnode; *IRiii* arising at or distad the subnode; 19-22 postnodal nervures in forewings, 18 to 22 in the hind. Origin of anal bridge variable, arising at or a short distance proximad of *Ac*.

Abdomen black, the ventral border yellow as far as segment 6, broadly so on segment 1 where it passes up on dorsum and is narrowly confluent at the apical border; segment 2 with its middorsal carina finely yellow, as also segments 3 and 4; a pair of small bright yellow baso-dorsal spots on segments 3 to 5, that on 3 being confluent with the yellow on side; the apical border of segment 9 and the whole of segment 10 bright chrome yellow.

Anal appendages bright yellow; superiors about as long as segment 10, broad at base, broad and shallowly notched at apex as seen in profile, obtuse at apex as seen from dorsum, a small spine tipped with black on the ventral inner surface about middle of appendage; inferiors broad at base, ungulate and very sinuous thereafter as far as apex which is rounded in profile, but curled strongly in and acute as seen from above. Penis with very blunt apex, cupped and with two very narrow branches springing from its middle which curl strongly back to embrace stem of organ and then turn abruptly back at ends; a robust spine on dorsum of stem lying within the arch of apex.

Female. Abdomen 40 mm. Hindwing 28 mm.

Differs in several respects from the male, shorter and more robust; bases of mandibles, genæ, anteclypeus except for a small black spot on each side, and the anterior border of frons very finely yellow; 2nd joint of antennae tipped with yellow; oval spots on vertex replaced by a beaded transverse stripe traversing the vertex between the ocelli; elongate spots behind eyes larger; eyes bordered narrowly with yellow beneath.

Prothorax very broadly yellow at sides; posterior lobe almost absent, merely a small black lobe on each side, the broad notch between bright yellow.

Thorax black on dorsum marked with a narrow bright yellow antehumeral stripe on each side which replaces the broad sulphur yellow fascia seen in the male. Laterally similar to the male.

Legs and wings similar to the male; 20 to 21 postnodal nervures to forewings, 19 in the hind; *Riv+v* and *IRiii* arising a little proximad and a little distad of the subnode respectively; *Ab* arising at the level of *Ac*.

Abdomen black with a yellow stripe running along the whole length of the ventral border; segment 1 entirely bright yellow save for a small dorsal basal black spot; segment 8 with a large apical dorsal spot covering nearly its apical half; segment 9 with a similar spot, but bifurcating into two lobes which run slightly outwards and nearly as far as base of segment; segment 10 black with the dorsum yellow or more commonly, a small round spot on each side the middorsal ridge at the middle of segment.

Anal appendages black, short, conical, pointed; vulvar scales robust, not extending quite to end of abdomen, yellow, blackish below.

Distribution.—Upper Burma; the type comes from Puepoli and is in the Selysian collection. Occurs at Maymyo, Upper Burma from June to August. Paratypes in the author's, and British Museum collections. The male is easily distinguished from all others of the genus by the whole of dorsum of thorax bright sulphur yellow; not infrequently the anal bridge is found to arise proximad the level of *Ac*, thus differing from other species and approximating to *Calicnemis* and *Indocnemis*. The female is distinguished by the yellow markings on the terminal abdominal segments which are very distinctive.

Coeliccia fraseri Laidlaw (1931).

Coeliccia fraseri Laid. Rec. Ind. Mus. MS. (1931).

Male. Abdomen 37 mm. Hindwing 23 mm.

Head,—labium pale yellow; labrum dark brown bordered with paler brown; bases of mandibles, genæ, anteclypeus and the lateral part of frons pale blue; vertex and occiput and beneath eyes matt black, the former with a pair of round bluish spots lying in the triangle formed by the ocelli, and an oval spot on each side between the ocelli and base of antennæ; occiput with a vestigial pale yellow oblong spot on each side behind the eyes; the latter black above, olivaceous on the sides and beneath.

Prothorax black, broadly blue or yellow laterally; posterior lobe rounded, simple.

Thorax black on dorsum as far lateral as the anterior half of the mesepimeron, marked by very narrow dorsal blue or yellow stripes which lie close to and parallel with the middorsal carina, extending the whole length of dorsum. Laterally and beneath pale blue with a narrow black stripe mapping out the postero-lateral suture, incomplete below; a small spot, sometimes obsolete, on the upper part of humeral suture.

Legs yellow, posterior surfaces of femora and the tarsi black. Wings hyaline; pterostigma reddish brown framed in pale yellow and thick black nervures, covering one and a half cells, braced; 16 to 17 postnodal nervures to forewings, 15 in the hind; *Riv + v* arising at a variable distance proximad to subnode; *IRiii* arising at or a little beyond subnode.

Abdomen blackish brown on dorsum, bluish near base and yellow elsewhere on the sides; segment 1 broadly blue or yellow laterally; segments 3 to 7 with small paired basal dorsal spots confluent with the yellow on sides and beneath; segments 7 to 9 black on dorsum; segment 10 black changing to reddish brown and then broadly yellow on the side. Some specimens with the apical border of segment 9 broadly pale yellow, the base black, this extending as two dorsal points apicad; segment 10 in the same specimens wholly pale yellow.

Anal appendages pale yellow, inferiors black on dorsum and apices; superiors narrow at base and hollowed out as seen from above, then broadening and club-shaped, very obtuse at apex and with two inner points or broad spines at their middle; inferiors broad at base then tapered and ending in an obtuse or rounded apex which is slightly curled in as seen from above. Penis closely similar to that of *C. chromothorax* but the branches forming a watch-spring spiral and not directed back at ends.

Female. Abdomen 33 mm. Hindwing 24 mm.

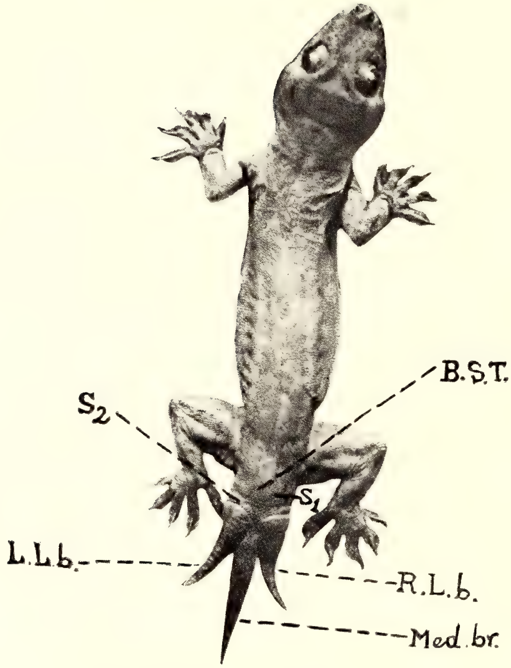
Closely similar to the male, far more so than is general within the genus; differs as follows, labrum golden yellow with a tiny black point at base in the middle line; blue of genæ almost meeting across frons; spots on vertex coalesced to form a complete slightly beaded stripe extending from eye to eye between the ocelli.

Prothorax bright yellow, anterior and posterior lobes deep black, as also a fine middorsal line on middle lobe; posterior lobe trilobate, projecting markedly over front of thorax. Wings with pterostigma ochreous, the central portion brownish; 17 to 18 postnodal nervures in forewings, 15 to 16 in the hind; *Riv + v* and *IRiii* variable as in the male. Abdomen similar but segment 8 with a broad apical yellow annule occupying one-third of its length; segment 9 variable, dark brown or obscurely marked with yellow on dorsum and apical border; segment 10 reddish brown as also anal appendages which are short, conical pointed.

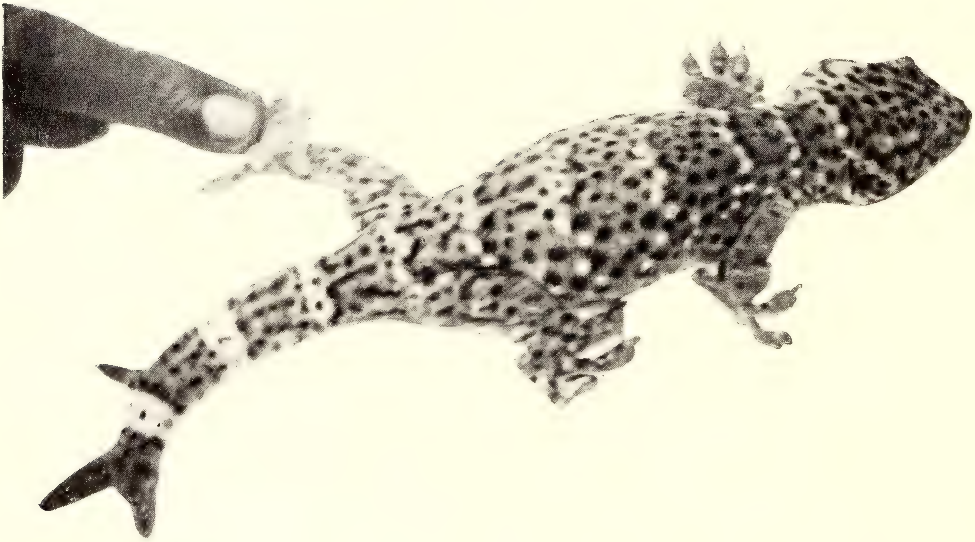
Vulvar scales moderately robust, yellow, the base and beneath black.

Distribution.—Khasia Hills, Assam. The type in the British Museum comes from Shillong, 5,000 ft. The species is stated by Mr. T. Bainbrigge Fletcher to be common in jungle near streams in June and July, extending into August. Distinguished from other species by the parallel blue or yellow dorsal lines on thorax lying in close apposition to the middorsal carina. The female bears the same marking which will serve to determine it from the females of other species from India. Only old adults have blue thoracic markings, and in very old specimens, the dorsal stripes are completely obliterated.

(*To be continued*).



Dorsal view of *Hemidactylus flaviviridis*, **Rüppel with a trifid tail. Specimen B.**



Dorsal view of *Gecko verticillatus*, **Laurenti with a trifid tail produced artificially.**

OBSERVATIONS ON THE TRIFID TAILS IN TWO SPECIMENS OF *HEMIDACTYLUS FLAVIVIRIDIS*, RÜPPEL, WITH A NOTE[1] ON THE ARTIFICIAL REGENERATION OF DOUBLE AND TRIPLE TAILS OF THE "TOKHAK" LIZARD, *GECKO VERTICILLATUS*, LAURENTI.

By

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(*With 1 plate and a text-figure.*)

Introduction.

Two specimens of ordinary house-lizards (Geckos), each with a trifid tail, were caught—one from the students' quarter, 35, Ballygunge Circular Road, Ballygunge, Calcutta, by the author himself and the other from the Professors' quarters situated within the compound of the same premises by Master Ajit Kumar Sarkar. The chief interest lies in the fact that under ordinary circumstances, the regenerated tail in Geckos is generally a straight continuation (without any sign of segmentation on the surface, except for certain differences in scaling) of the portion of the original tail left intact, whereas in the present case each specimen bears two lateral accessory regenerated branches in addition to the median regenerated tail. From a careful study of the detailed structure it was found that these two lateral branches of the tail differed markedly from the median one, and also from the double and the triple tails which were produced artificially in the laboratory by injuring either certain portions of the vertebral column of the normal tail or the cartilaginous tube of the regenerated tail of *Gecko verticillatus*.

Regeneration of tails in Geckos is not an uncommon feature, and has been referred to by several authors, and the literature dealing with allied or nearly related cases has been cited in the present communication.

General Description.

The description of the two specimens of *Hemidactylus flaviviridis*, Rüppel, each possessing a trifid tail, is as follows :

I. External Characters—Specimen A (Figs. 1 and 2).

(a) Measurements :

(i)	Length from snout to the vent	8·6 cms.
(ii)	Greatest breadth across the abdomen	1·95 cms.
(iii)	Length of the head	2·35 cms.
(iv)	Breadth of the head	1·63 cms.

The portion of the original tail left intact (Figs. 1 and 2 ; S_1-S_5), measured 2·3 cms. from the vent. This piece of the original tail, as seen externally, is composed of five segments (S_1-S_5), each segment being marked by the presence of four large conical scales except the basal segment (B.S.T. or S_1), where such scales are not represented. Two of these large scales are lateral in position, and are much more prominent than the two mid-dorsal ones. The whole of the regenerated tail (Med. br.) measures 4·35 cms. in length from its origin up to its tip. At a distance of nearly 9 mm. from base of the regenerated tail there arise two small accessory lateral branches apparently from the dorso-lateral walls of the regenerated tail itself. The latter is thus continued as the median tail (Med. br.), though there is a slight indication of a groove on either side, both along the dorsal and the ventral sides, just behind the origin of the two small lateral branches. The grooves run from the lateral sides, converging towards the antero-mesial direction. The right lateral branch (R.L.b) measures 4·5 mm. in length, whereas the left one measures 3·5 mm. The median branches of the tail (Med. br.) measures 3·45 cms. in length from behind the origin of the lateral tails. The diameter of the common trunk of the regenerated tail, i.e. of the common basal stump (C.R.T.), supporting the lateral accessory as well as the median tails, immediately in front of the two lateral branches, is about 7 mms., whereas the diameter of the base of the median branch lying just behind them is about 4·5 mm.

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[1] *Cf.* Proceedings of the Indian Science Congress held at Nagpur in 1931.

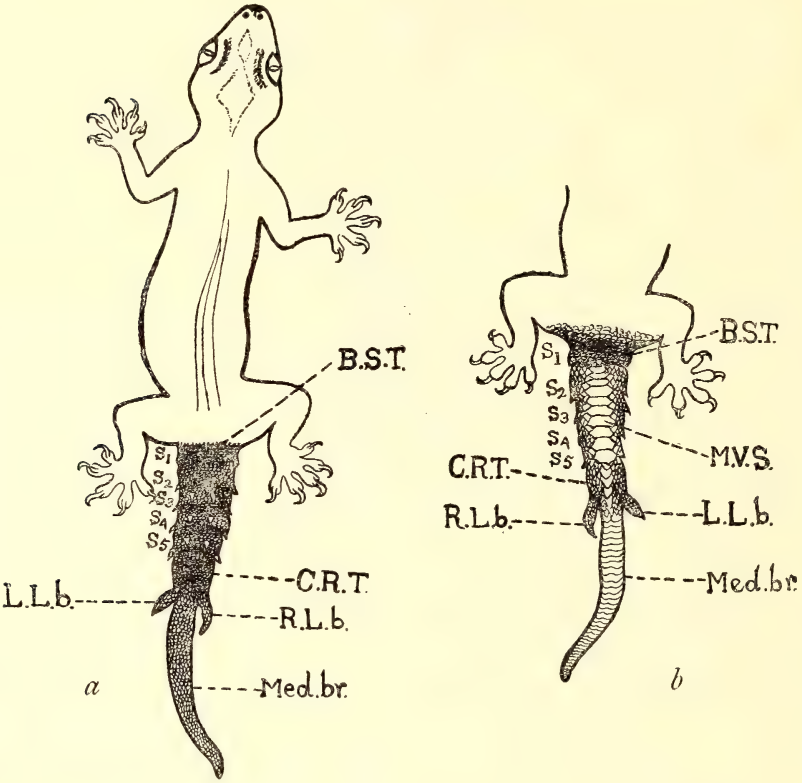

FIG. 1. Diagrammatic sketch of *Hemidactylus flaviviridis*, Rüppel, with a trifid tail ; Specimen A. *a*. Dorsal surface ; *b*. ventral aspect of the tail region

(b) Scaling :

As regards scaling there is a very marked difference between the original portion (i.e. part of the normal tail left intact) and the regenerated portion of the tail. In the former case the scaling on the dorsal surface is more regular, and each segment as seen externally has four large conical scales as referred to above, which are absent from the regenerated tail. The general covering of scales (dorsal and lateral) over the region of the tail in front of the origin of the two lateral accessory branches, i.e., both over the normal portion of the tail as well as over the common regenerated trunk, are small and very nearly of the same pattern, while those over the three regenerated branches (i.e., the two lateral branches and the median one) are slightly larger and dissimilar, and are arranged irregularly. The mid-ventral row of large laterally elongated scales (fig. 2 *b*; M.V.S.) prominently seen on the original tail, also extends over the common regenerated trunk as well as over the median branch of the regenerated portion of the tail, but here they are strikingly different in form and shape; and the lateral branches, viz., the accessory tails, are devoid of such large scales; in other words, the latter are covered over by small scales only which are of the same pattern both on the dorsal and the ventral sides.

(c) Colouration :

As to the colouration, the three regenerated branches are slightly more greyish in appearance than the rest of the tail.

SPECIMEN B. (Pl. 1)

(a) Measurements :

(i) Length from snout to the vent........................8·1 cms.
(ii) Greatest breadth across the abdomen............1·95 cms.
(iii) Length of the head...2·1 cms.
(iv) Breadth of the head..1·65 cms.

The portion of the original tail (Pl. 1, S_1–S_2) left intact measured 7·5 mm. This portion of the original tail is really composed of two segments, and, as seen externally, it is marked by a definite groove which separates the basal segment (B.S.T. or S_1) from the posterior one (S_2)—both of these having no conical scales : the absence of such scales from the posterior segment is an uncommon feature, and is probably due to destruction caused by certain injuries over the area bearing these scales. Out of the three branches of the regenerated tail, the median branch (Med. br.) is larger than the two lateral ones and measures 2·45 c.ms., whereas the right lateral branch (R.L.b.) measures 1·75 cms., and the left one (L.L.b.) 1·7 cms. The two lateral accessory branches are comparatively larger than those of the specimen A, but the median regenerated tail is relatively smaller. The three branches of the regenerated tail arise directly from the very end of the original tail left intact, and not from a common regenerated trunk as in specimen A described above. A posterior groove on either side is very well-marked (especially on the dorsal side), and runs from just behind the base of each lateral tail towards the antero-mesial direction as seen in specimen A, but the line of demarcation between the original portion of the tail and the regenerated portion is very clearly marked in this particular specimen (not so well differentiated in the former case), and runs postero-mesially from the lateral sides to meet at a common point at which the two posterior grooves (just mentioned) also unite. The diameter of the common base (from which are given off the three branches) of the regenerated tail is 1·2 cms., whereas the base of the median branch, i.e. of the region lying immediately behind the origin of the two lateral accessory branches, measures ·4 cm. across its diameter.

(b) Scaling :

The dorsal scaling of the three regenerated branches differs from that of the original tail in being irregular and larger in size, but the mid-ventral row of laterally elongated scales are present on all the three branches, and are of the same pattern. In this respect, viz., in the possession of the mid-ventral row of scales on all the three regenerated branches of the tail, specimen B differs very strikingly from specimen A.

It is a noteworthy fact that the scales of the regenerated (renewed) tail, or of the accessory tails differ from those of the original (normal) tail in those reptiles, which have the power of reproducing their tail, but according to Boulenger (3) this view is erroneous, and " in some cases, the aberrant scaling of the reproduced tail is a reversion to an ancestral form."

(c) Colouration :

The colouration of the regenerated tail is pretty nearly the same as in specimen A.

HISTOLOGY.

Specimen A.

In the regenerated tail, as we know, a cartilaginous tube extends from the very end of the portion of the original tail left intact, in continuation with the last vertebra (i.e. the portion actually left over), up to the end of the regenerated tail. By section-cutting it is found that the two lateral accessory branches bear no such cartilaginous tube as that seen in the median regenerated portion in which it is continued straight backwards from its base. There is a fairly well-developed groove encircling the cartilaginous tube, i.e., there is a distinct constriction at the point from where the two lateral tails are given off. Serial frontal sections also show that the cartilage cells at the constriction are comparatively much larger than those of the other parts, and are in a state of proliferation, and they push their way inwards towards the central canal lodging the spinal cord. There is also a connective tissue investment encircling the tube, but this is interrupted at the constriction.

The histological condition of the central cartilaginous tube, viz., the presence of a very distinct constriction as well as discontinuity of the connective tissue sheath in the constricted area, suggests that probably the anterior portion of the regenerated tail, i.e., the basal stumpy portion (Figs. 1 and 2; C.R.T.) is *primarily* regenerated from the sides of which are developed the two accessory fleshy lobes (R.L.b. and L.L.b.), whereas the median part (Med. br.) of the tail is *secondarily* regenerated—the fleshy lobes being probably formed after the median part has sufficiently developed due to certain injuries being received over the common regenerated trunk near the junction of the two portions of the regenerated tail.

The cartilaginous tube is devoid of any segmentation and perforation. It tapers with the tail, and its lumen ends blindly at the tip.

Neural and hæmal arches are wholly wanting in the area of regeneration.

Inside the lumen of the cartilaginous tube the following structures are present :—

(*a*) The tapering part of the spinal cord in continuation with the cellular lining of the canalis centralis, and practically having very few external nerve fibres.

(*b*) A network of blood-vessels—the capillaries being irregularly disposed here and there.

(*c*) A very few pigment cells are also scattered about.

(*d*) The fatty layer is extremely thick, and consequently the musculature is thin within the median regenerated tail, but the two lateral accessory branches are mainly muscular outgrowths with a limited number of adipose cells.

Specimen B :

As in specimen A the cartilaginous tube is one continuous piece, and forms the central axis of the median regenerated tail only. The lateral branches are devoid of any such structure ; that is to say, these are merely fleshy outgrowths, without any hard supporting structure inside them. Further, in the absence of any groove or constriction towards the anterior part of the cartilaginous tube and in the presence of a continuous sheath of connective tissue, it is so very characteristically different from the previous case already described.

It appears that in this case *the whole of the newly added tail is primarily regenerated,* and owing to injuries having been received towards its anterior end, two fleshy lobes (Pl. 1; R.L.b. and L.L.b.) have thus developed later in life. But the injuries in this specimen had possibly also affected the mid-ventral row of scales of the regenerated tail, which probably thus led to the extension of these scales over the ventral sides of the lateral branches as well, whilst it might be remarked that in specimen A the injuries had not gone far enough to affect the mid-ventral row of scales, and consequently, the latter was absent from the accessory lateral tails of that specimen.

GENERAL REMARKS.

To be brief, it may be said that the regeneration or the production of double or triple tails in lizards (1, 2, 4, 5, 6) is by no means an uncommon phenomenon under natural conditions. That might be due to certain accidents, either to partial injuries to the muscular coat only, or to deeper injuries affecting the muscular layers as well as one or more vertebræ of the original tail.

Tornier (7) has been able to produce experimentally double and triple tails in the case of *Lacerta agilis* with cartilaginous tubes forming the central axes or supporting structures for the lateral outgrowths.

Woodland (8) has succeeded in producing an extra tail without any cartilaginous tube entering into it in each of the four examples of *Hemidactylus* *flaviviridis*, Rüppel. This accessory tail is, therefore, simply a muscular outgrowth from the side of the original tail, or from that of the regenerated tail.

From a series of well-graded experiments conducted on the caudal autotomy of a less common lizard, *Gecko verticillatus* (pl. 3) in the laboratory by injuring the tails in various ways, I have observed in nearly all cases (out of many double and triple tails having been produced), that a lateral outgrowth or accessory tail is produced from the normal, or from the regenerated tail without any supporting skeletal structure when the injury is not sufficiently deep, i.e., when it affects the muscular coat only. In such cases, the accessory regenerated tails are merely elongated fleshy lobes, but if the wound is sufficiently deep, and has affected either the vertebral column of the original tail, or the central cartilaginous tube of the regenerated tail, then in all such cases, an accessory cartilaginous tube[1] is also developed from the point of injury, and extends as a supporting structure inside the accessory regenerated tail.

From the experimental results on the regeneration of tails in certain Lacertilians obtained by Tornier (7), Woodland (8), myself and others, it clearly follows that an accessory tail without a cartilaginous tube may not be an unusual feature, and that in order to produce an accessory tail with a central cartilaginous tube, the injury must be deep enough to reach the vertebral column of the original tail, or the central cartilaginous tube of the regenerated tail.

The three-tailed condition (or the trifid tails) of the two specimens of *Hemidactylus flaviviridis*, each possessing, *i.e.*, two accessory fleshy lobes without any supporting skeleton, together with the median regenerated tail bearing a central cartilaginous axis, is undoubtedly the outcome of injuries apparently received twice due to certain unknown causes, firstly, to the deeper parts of the original tail, affecting its vertebral column and severing it completely, and thus producing a median regenerated tail, and, secondly, to the muscular part of the regenerated tail thus produced on its both sides : under the latter circumstances two accessory muscular lobes have developed.

Here I wish to express my indebtedness to Professor B. K. Das, D. SC., for his constant guidance, invaluable suggestions and kind criticisms. My thanks are also due to Master Ajit Kumar Sarkar for the gift of the specimen.

EXPLANATION OF PLATE.

Fig. 1. Photograph of the dorsal view of *Hemidactylus flaviviridis*, Rüppel, with a trifid tail. Specimen B.

,, 2. Photograph of the dorsal view of *Gecko verticillatus*, Laurenti, with a triple tail produced artificially.

LIST OF ABBREVIATIONS USED.

B. S. T.	... Unsegmented base of the original tail.
C. R. T.	... Common regenerated trunk.
L. L. b.	... Left lateral branch or accessory lateral tail.
Med. br.	... Median branch of the trifid tail.
M. V. S.	... Mid-ventral row of scales.
R L. b.	... Right lateral branch or accessory lateral tail.
S_1-S_5.	... Segments of the portion of the original tail left intact.

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2. Idem. 'Some cases of Caudal abnormality in Mabuia carinata and other Lizards'. *Jour. Bombay Nat. Hist. Soc.*, vol. xi, pp. 680-89, 1897-98.

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[1] Tornier (7) has shown that more than one cartilaginous tube may also extend inside a single accessory tail, if two or more neighbouring vertebræ be injured.

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OBITUARY

MISS JOAN PROCTER

(*From the 'Times', September 21st, 1931.*)

We regret to announce that Miss Joan Beauchamp Procter, D.SC., F.L.S. F.Z.S., died yesterday after a prolonged period of illness at the age of 34.

Miss Procter was born in London on August 5, 1897, the younger daughter of Joseph and Elizabeth Procter, grand-daughter of Thomas Procter, of The Hoo, Great Gaddesdon, a Hertfordshire squire and of William Brockbank, a wealthy Quaker iron merchant of Manchester, a friend and patron of the pre-Raphaelite painters, and a proficient amateur in botany and geology. Joan was fragile and delicate from birth, and probably the only time in her life when she was physically happy was during six months spent in Switzerland in her twelfth year, when she gave herself up to botany, dancing and reckless tobogganing. Her education at St. Paul's School for Girls was much interrupted by illness, but she was recognized as a student of resolute will-power and brilliant ability. Her health made it necessary to give up her intention of going to Cambridge, but an opening congenial with her natural gifts presented itself.

From her earliest childhood she was devoted to all living creatures, but specially to reptiles and amphibians. She knew the haunts and the habits of all the British species, and had tamed and kept most of them in homes of her own devising. As a small child she had rejected dolls for a large green Dalmatian lizard, which travelled everywhere with her and sat at table beside her at meals. While still a small school girl she had gone to Dr. G. A. Boulenger, Keeper of Reptiles and Fishes at the British Museum, to ask him some question about the structure of a reptile, and he, recognizing that she was a naturalist by disposition, had helped and encouraged her and continued to take an interest in her. In 1917 when her Cambridge ambition had to be given up, Dr. Boulenger invited her to assist him at the Museum. From 1917 to 1920, she worked with him, and on his retirement in 1920 until 1923, she was in entire charge of the collections of Reptilia and Batrachia. During that time Miss Procter acquired a wide knowledge of her subject, and was the author of a series of original papers which established her reputation in the museums of the world. (She contributed various papers on the Reptiles of Mesopotamia and Persia to the *Journal of the Bombay Natural History Society*[1].)

In 1923 Dr. Chalmers Mitchell, the Secretary of the Zoological Society, who knew her artistic and technical ability from the models she had made for the show cases in the Natural History Museum, and from the surgical splints she had made for one of the War hospitals, invited her to assist Mr. E. G. Boulenger in designing and constructing the rockwork and backgrounds in the New Aquarium, a task which she accomplished with brilliant success. When the Aquarium was completed Mr. Boulenger became its director, and the council appointed Miss Procter to succeed him as Curator of Reptiles and Amphibia. No appointment could have been more successful. Through her acquaintance with those interested in reptiles in almost every part of the world, Miss Procter rapidly increased the collection. Her knowledge of the habits of her charges and her power of close and sympathetic observation led to many improvements in their health and comfort. She followed the work of the Society's pathologists in the *post-mortem* room, and was soon able to recognize the earliest traces of diseases and to devise appropriate treatment. She became an expert surgeon, excising tumours, dressing sores, and cleaning out and plugging abscesses, and more than one distinguished surgeon has watched her with amazement and admiration operating on the mouth or the eye of a cobra or rattlesnake with apparatus of her own devising.

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*Editor's Note.

The old Reptile House was unsatisfactory in many respects, and when the Council of the Society found it financially possible to construct a new one Miss Procter planned every detail from the general lay-out to the drains, electrical heating, and decorative backgrounds. The architects, contractors, electricians and decorators had a rough time until they realized that the positions of drain-plugs, electric heaters in rocks, or shelves for the store of anti-venomous sera had been fixed with a purpose and could not be changed without consultation. The house when completed won universal admiration from visitors, and its technical efficiency has set a new level in the possibilities of keeping reptiles in captivity.

Physically Miss Procter was excessively fragile, and for many years she seldom passed 24 hours without severe pain. A series of severe internal operations had prolonged her life, but had left her in a condition which only a resolute will made less than complete invalidism. From time to time, but with increasing frequency latterly, she had prostrating illnesses, but when it was physically possible she went daily to the Reptile House in an electric bath-chair, passing the intervening periods in bed. At the worst she had daily reports by telephone from the Reptile House to her bedroom, and daily visits from her colleagues and subordinates. In between her bouts of pain she was gay, witty, and thoughtful for every one. All who knew her personally were devoted to her, and those who knew her work recognized her extreme ability. The best likeness of her was a marble bust by G. Alexander exhibited in the Royal Academy this year. It has been purchased for presentation to the Zoological Society.

REVIEWS.

1. SHORT HISTORY OF THE CEYLON GAME AND FAUNA PRESERVATION SOCIETY.—By A. C. Tutein Nolthenius, F.Z.S., 1894–1931.

In this 'Short History of the Ceylon Game and Fauna Protection Society', compiled and edited by Mr. A. C. Tutein-Nolthenius, F.Z.S., and covering the period 1894 to 1931, we are given 'The Story of the Society' which 'is that of a long-sustained fight to gain from Government the indispensable protection without which the Game and large Fauna of the Island would have been almost, if not altogether, exterminated long before our time.'

The statistics and other information contained in this booklet of 64 pages (with six illustrations) show very clearly that had it not been for the influence of the Society and its Members, the sambur and spotted deer, and probably the buffalo also, were doomed to extinction.

In a most interesting Report (1907) on 'The Wanton Destruction of Game in Ceylon' (which is reproduced in full) by Mr. Harry Storey—7 years Honorary Secretary and 11 years, Chairman of the Society—figures are given which show that during the eight years 1894 to 1901, there was a *yearly* slaughter of 65,883 spotted deer and 9,930 sambur ; and in 1902, Mr. Thos. Farr calculated that for the previous two years 69,328 stags 'and I will not attempt to calculate the number of hinds' were killed.

'It is the one great ambition of every adult male' says Mr. Storey, 'to possess a gun, and it may be taken for granted that nine out of every ten men in every village in Ceylon, near which any sort or kind of bird or beast can be shot, possess and use guns'. No restriction of any sort or kind is placed by Government on the possession of firearms by anyone in Ceylon.

From this state of affairs in 1907, and other difficulties stated in the same Report, it can be imagined that the Society had indeed an up-hill fight to get anything done ; and indeed counsels of despair almost prevailed in the year 1912, for at a General Meeting held in April of that year 'the closing down of the Society altogether was considered'. Fortunate it was for the future of the Wild Life of the Island that the Meeting was prevailed upon by the Chairman, Lieut.-Col. Gordon Reeves 'to carry on for two or three years more and see how things went'. In that year Mr. Harry Storey was Honorary Secretary, and for the following ten years he was Chairman ; so the Society struggled on.

The Yala Sanctuary was initiated in February 1899, and in 1901 it was reported that deer had largely increased ; while in 1904 it was reported to be an uuqualified success. In 1918 this Sanctuary was reported as 'not overcrowded', but in 1920 it was found necessary to take steps to thin out the number of animals by driving some of them into the reserves : and in 1927 the issue of special licenses for the purpose of thinning out the buffalo bulls and the stags was sanctioned. Thirty-seven bulls and 106 stags were shot.

From the history of the Yala Sanctuary, it is evident that such areas should not be too long maintained, but should be thrown open and a fresh area declared.

In 1910 there were two Sanctuaries aggregating 367 square miles (238,880 acres), and at the present time, there are three Sanctuaries which aggregate 275,000 acres.

In the matter of guns it is stated that in 1910 there were 47,407 weapons licensed, the holders of which had but 523 licenses to shoot game. 'An utter farce' indeed, which still continues as in 1929, the weapons were 66,936 and the game licenses only 836.

Guns and rifles imported into Ceylon for the five years 1922–1927 numbered 20,491 (S. B. guns 16,294, D.B. guns 3,068, rifles 1,129) a *yearly average* of 3,415 imported weapons ; and with these came a yearly average of 1½ million loaded cartridges. Poor birds and beasts, they have indeed a hard struggle for existence.

The remark of your reviewer on these figures is that as the people appear to want weapons for purposes of display only (being adequately protected from external enemeis by the British Government), the number of licensed weapons might reasonably be reduced to—say—936 (100 more than the apparent sporting requirements) and the remaining 66,000 unnecessary weapons called in. Why not ?

Similar figures for India would be very interesting. It is notorious that crop protection weapons are used for shooting in and out of season in neighbouring and distant jungles, and but few shots are ever fired on the land of the license holder. All the ' gun ' noise sufficient for keeping animals from the crops can be made by means of the pole, pestle, and detonator method in use in the few localities where the people do not possess firearms. But all this is by the way.

Despite all the efforts of the Society during 37 years we read that the Wanderoo Monkey—of which a thumb-nail sketch is in the margin of the booklet—and the Rock, or Giant Squirrel, are still unprotected ; and Ceylon seems to have been unfortunate in its governors as regards Game Protection, the only one who is favourably mentioned during all these struggling years being Sir Henry McCallum, G. C. M. G. etc., under whose auspices (1908), the all important Dried Meat Ordinance became law. It was mainly due to the untiring efforts of Mr. Harry Storey, ' The Doyen of the Game Preservation Society ', that this Ordinance, without which all else was of little avail, became an accomplished fact. His portrait is the first in the book.

Following on this came the Game Ordinance (No. 1 of 1909) and, for the first time since the institution of the Society the object it had been striving for, viz., *Protection*—seemed likely to be attained.

But one thing remained—the proper enforcement of these Ordinances. That is the whole crux of the matter. It is especially difficult without the active co-operation of Government to enforce laws affecting animal life : witness the Wild Birds and Animals Protection Act of India which is by all accounts pretty well inoperative.

It has been recently urged in the public Press in India that unless action is now taken in the matter of preservation of the larger fauna of the country, it will soon be too late. That this is so those of us who are in a position to find out by visiting forests in various parts of the land know only too well ; but without the active and continuous support of Government by means of suitable laws *properly enforced* all will be but useless endeavour. Probably at the present time the answer of the Indian Government would be that of the Ceylon Government in reply to urgent representations of the Society for effective action in 1907 : ' Our Game Laws are quite efficient, *but* we regret we have not the power to enforce them ! '

While the practically unlimited possession of arms in India continues, it is but little that can be done except in the Reserved Forests of the Forest Department. And if the policy of hindrance which seems to be gaining ground in one part of one of the Provinces continues, then the animals of even the Reserved Forests are doomed ; for it can only be productive of good from every point of view that the right sort of sportsmen be encouraged and afforded every assistance to obtain shooting blocks. The more the shooting blocks are occupied the greater is the check on the destruction of game.

Rinderpest is mentioned as having caused much loss among the buffalo, sambur and pig, but the spotted deer were not affected by the disease. It would be interesting to have authoritative information as to whether this animal has been similarly immune in India.

The History contains an extremely interesting article (1910) by Mr. Thos. Farr on ' The Inflorescence of the Nilu (*Strobilanthes*) ' which will be of much interest to dwellers on the Nilgiri Hills. With this article is reproduced a portrait of Mr. Farr, a true sportsman and lover of wild life, who was for some ten years the Honorary Secretary of the Society and did much in its early days for the Preservation of Game in Ceylon.

Of Mr. G. M. Crabbe who was for some 17 years either Chairman or Honorary Secretary, and is now a Life Member of the Society, and who was one of the first to lay aside the rifle in favour of the camera, a portrait is given ; also one of Mr. Henry Englebracht, ' an irreconcilable Boer prisoner ' who was in charge of, and did so much for the Yala Sanctuary during the years 1907-1928. In that last year he died and the grateful Society placed a memorial on his grave at Hambanteta.

There is of course much that remains to be done, for in matters affecting the protection of animal life, the work can never be even relaxed. That this is so is clear from extracts given of a lengthy Memorandum sent to the Colonial Secretary in January 1929 in which, among many matters, it was pointed out that if the present rate of destruction of wild life is to continue a number of useful and beautiful species will be exterminated, and that within a few years the animal and bird life in general will be seriously depleted; that the Laws relating to game protection, gun licenses, and provision of Sanctuaries should be revised; and that a Government Department for the conservation and/or control of game and wild life should be established immediately. And there the matter rests, and, judging from past and present history, is likely to rest for many a weary period of years.

Ceylon is a Buddhist country and one of the principal tenets of the Buddhist religion is 'Kill not, lest ye slay the meanest thing upon the upward way'; so perhaps the 66,000 unnecessary guns will be withdrawn, perhaps not.

Mr. Tutein-Nolthenius closes the History, which he has compiled with so much labour, with a plea for establishment of a National Park; for, as he points out, 'A Reserve or Sanctuary is proclaimed by Government in the Government Gazette, *but*—in the same manner as it can be proclaimed it can also be unproclaimed, and done away with entirely, either by the same or by another Government. A National Park is Permanent for ever, Permanent by legislation, vested in Public Trust, a National Public Property, a property to be interested in and to be proud of'.

The thanks of the members of the Society, and of the public of Ceylon in general, are due to the Compiler of this History who undertook the writing of it as a labour of love in order to answer the question frequently asked 'What does the Game and Fauna Protection Society do—what has it done in the past?'

This he has amply shown, as also what is required in the future which can be concisely described as Game and Wild Life Department; the withdrawal of all unnecessary guns; the establishment of National Parks.

R. W. B.

2. BUTTERFLIES OF LAHORE.—By D. R. Puri, Punjab University.

My attention has been drawn to a somewhat extraordinary paper on the 'Butterflies of Lahore' published by the Department of Zoology of the Punjab University. The author, Mr. D. R. Puri, appears to have made a collection of butterflies in Lahore during the summer of 1925, many members of which he has failed to identify correctly. The paper is a pretentious one, containing long lists of unnecessary references and some elementary information regarding mimicry and protective resemblance, which the author incorrectly imagines to be original. A not inconsiderable expenditure has been incurred upon the production of four coloured plates.

Of the 57 species listed the four following can, under no circumstances, appertain to the fauna of Lahore: viz., *Aporia soracte* and *Ypthima nareda*, Himalayan insects not occurring below 5,000 feet: *Argynnis aglaia*, a European butterfly which only reaches the Indian Empire in Chitral and the countries nearby, flying at over 6,000 feet: *Araschnia levana*, also a European butterfly, which does not even occur in the near neighbourhood of the Indian Empire.

A number of the other species recorded are most unlikely to have been obtained in Lahore and no serious collector could accept them without verification by himself or by an accepted authority.

To collectors, who wish to know what butterflies can be obtained in Lahore, reference is invited to a paper on the subject that appeared on page 136 of vol. xxv of the *Journal of the Bombay Natural History Society*. The author, Mr. G. W. de Rhe Philippe, O.B.E., is a well-known collector, and his results were based on four years' collecting.

November 2, 1931 W. H. E.

3. P. R. AWATI, B.A., D.I.C., I.E.S., and H. S. RAI, M.Sc.—*Ostrea cucullata*. The Bombay Oyster., xi, 107, 51 figs. Lucknow, Methodist Publishing House, 1931. (Rs. 2-8).

The collection of the Indian Zoological Memoirs on Indian Animal Types edited by Dr. K. N. Bahl and started by him with the extremely interesting study on *Pheretima* has been enriched by a new Memoir on the Bombay Oyster.

Already the very idea of providing Indian students and workers with typical collections, such as their colleagues in other countries enjoy, deserves every encouragement; but we are glad to add that considering the work of Bahl, of E. M. Thillayampalam (on *Scoliodon*) and this one of Awati and Rai, the realization has been so far entirely successful and praiseworthy.

The work which occupies our attention is absolutely well done. It is thorough and clear. It not only realizes its purpose, within the limits of the collection, but it also hints at interesting problems which claim further treatment. This is always the immediate result of direct observation and first-hand work: and we should like to urge Messrs. Awati and Rai to let us have the benefit of their studies on such interesting questions as the *symbiosis* or *parasitism* of *Pinnotheres*, the organogenesis, and the sex changes, which have so much attracted the attention of research workers in the case of European oyster, and other physiological problems, which apparently in the mind of the authors would have encumbered the clarity and fluency of the Monograph.

May we be allowed to remark that the branchial cavities should perhaps better be called inhalant and exhalant chambers.

The book like the others of the collection is well presented and amply illustrated.

And we are glad to see that, thanks to the painstaking efforts of Awati and Rai our *Ostrea cucullata* is no longer a poor relative of the fortunate *O. edulis*.

G. P. de B.

4. W. O. JAMES, B. SC., PH.D., D.Phil.—An Introduction to Plant Physiology. i-viii+259. Oxford, at the Clarendon Press, 1931. Price 7 *sh.* 6*d.* net.

The author states in his Preface that the book is written for readers of senior school or junior university status. His main intention was to give a balanced account of the more elementary aspects of plant physiology. He has not neglected recent research but has made use of it only as far as general principles are concerned. Of controversial matter the student will find very little. Instead he is given a sound general account of elementary physiology which is apt to create a keen interest in the beginner. The treatment of the subject is excellent. After a short and clear exposition of the point under treatment in each chapter, the experimental work is set out in great detail. This is an admirable feature of the book as everybody will admit who has experience of students' practical work and who knows how important are all those little hints without which the experiment so often fails to be a success. At the same time not many claims are made on the laboratory and no special apparatus of an elaborate kind is generally required. The illustrations, which are mostly original, are exceptionally good and clear.

Though the book is primarily concerned with things going on inside the plants themselves, the author constantly draws attention to the ways in which these happenings depend on circumstances outside, i.e., he always takes environment into account, not making an artificial separation between internal and external events.

E. B.

5. A BOOK OF MAN-EATERS.—By Brigadier-General R. G. Burton 284 pages, 17 illustrations. Published by Hutchinson & Co. Rs. 12-6-0.

In his introduction to this book the author explains that it is for the most part a record of the experiences of many sportsmen and others; for it is not possible for any one man to come into contact with more than a few man-killing carnivorous beasts. He also acknowledges his indebtedness for material to the *Journal of the Bombay Natural History Society*, which he describes as a mine of valuable information, which indeed it is.

While, as the author indicates, the book deals with men, beasts, and reptiles, which kill and eat human beings, and perforce contains many thrilling and some gruesome stories; it is also designed to be a Natural History of Man-Eaters, and in this respect some account is given of the distribution, habits, and character of wild beasts and methods of hunting them. So, in the course of development of the book, the reader is afforded considerable knowledge as to the nature of particular animals and can from this appreciate why they taken to preying on human beings.

In discussing the question of fear of man in wild animals the author concludes that such fear, when present, is due to acquired experience. That is no doubt the case, for most wild creatures, when accustomed to seeing human beings, allow a very approach. There is no such thing in Nature as instinctive fear of human beings.

Those readers of the book who have practical knowledge of wild beasts and their ways will be interested in the remarks and observations on the question of the power of scent in the *Felidæ*.

At page 98 it is remarked as to the power of scent of the lion and tiger that further investigation is desirable. Sir Alfred Pease is quoted as being of opinion that the *Felidæ* have not a 'hound nose' but a 'winding nose'. No doubt this view is correct. When in the Pidoung Game Sanctuary last year the Game Warden showed the writer the place where he and the Chief Conservator watched a tiger walking in the open at right angles to the wind which was blowing from them. When he arrived at the place where the scent was carried to him, he at once bounded away with a grunt of alarm, not even looking to see where were the human beings whose presence was borne to him on the breeze.

That was a clear case of the ability of a tiger to scent human beings at a distance of about sixty yards. One knows that for panthers it is possible to sit on the ground to watch over a kill without being detected ; but to do so for tiger is not possible. One sportsman who thought otherwise was detected by the tiger coming to his kill and was fortunate in recovering from the wounds he received.

It is probable that the *Felidæ* have sufficient 'winding nose' to be able to detect the presence of game for some little distance. What that distance is, has yet to be ascertained.

The author is mistaken in supposing that the female panther which mauled him was over nine stone in weight. It is not many male panthers which attain that weight and probably not one female in ten thousand will exceed one hundred pounds. Eighty pounds is the weight of a large female of the species.

As to hyaenas the author is not able to assert that these beasts will kill and eat adult human beings; but cases do occur and the writer shot a female hyaena in Central India which had killed and eaten two women and a boy of twelve. She had cubs and was no doubt unable to find food for them.

Of wolves, much that is interesting is related, as also of wolf, children and were-wolves. Of crocodiles, alligators, and sharks, there are gruesome stories.

The book has a complete index. The name of a wandering tribe of gipsies in India is given as 'Brinjara': 'Banjara' is the pronunciation of the people, and is the more correct spelling of the word.

The illustrations, most of them reproductions from photographs, are good.

The author's style of writing is straight forward and easy, and the book will find many readers.

R. W. B

MISCELLANEOUS NOTES

I. THE OCCURRENCE OF THE FLYING-FOX (*PTEROPUS GIGANTEUS*) IN THE PUNJAB.

I. Very numerous during the mango season throughout Gurdaspur District, Punjab.

2. Numerous while the guava trees were in fruit.

3. Few about in early September. Never seen after the 19th September.

4. No resting places discovered in the plains of Gurdaspur District, but Flying Foxes were gradually traced to Kotla, which is 30 miles from Pathankote on the Kangra Valley road. Gurdaspur is 23 miles from Pathankote. It therefore appears that these creatures travel long distances daily.

GURDASPUR, C. BREADON,
26th October 1931. *District Engineer.*

There was some correspondence in the *Civil and Military Gazette* a few months ago regarding the distribution of Flying Foxes in the Punjab. Blanford in his *Mammalia* states that they are not known to occur in the Punjab and that they are not found in the Himalayas except at the base as a visitor from the plains. Presumably changed conditions in the Punjab since Blanfords' time, improvements in irrigation and the extension of horticulture have provided conditions which enabled the Flying Fox to establish itself in this Province. Writing in this connection Lt.-Col. J. E. M. Boyd says: " During the past 20 years I have frequently seen them at Ferozepore, where they come in when the fruit of the *Pipul* is ripe and also at Pathankote, Gurdaspur District. This year (1931) Flying Foxes have been seen in large numbers flying round the fruit trees at the British Military Hospital, Dalhousie." Recently the Society received a specimen of a Flying Fox from Mr. A. E. Jones, Simla. It is an example of the Nepal race *P. giganteus leucocephalus.*—EDS.]

II.—NUMBER OF CUBS IN A TIGER'S LITTER.

During December, 1930, Mr. Walter Draper of our Factory went out in his car for a jaunt in the country. Being a very keen shikari, he always takes his guns with him. About 30 miles out of Jubbulpore, he came across a likely looking spot and descended to try his luck with a view to securing some game birds for the 'pot'. On leaving the car, he and his friend walked about a couple of hundred yards from the main road, where they halted, and while discussing the best pathway to take, they heard the unmistakable sound of a large animal treading on dried leaves. The jungle here being pretty thick, it was difficult to get a clear view of the country round about. On turning round in the direction from which the sound originated, Mr. Draper caught a glimpse of the head and shoulders of a tigress as she passed broadside on. Following up the direction she was making for, he noticed an opening in the thick scrub, and realising she would soon come into view, he awaited his opportunity, which took but a few seconds to materialise. He at once fired, knocking her completely out of action in the one shot, the bullet having struck the base of her neck and lodged itself in the ribs. The skin of the animal was not removed till four hours after she was killed, when six cubs were taken out; all very much alive and kicking. They proved to be three males and three females, all perfect specimens in every detail including claws, etc. All died within an hour of removal. Presumably they would have been born within a few hours, and, had the proper measures been adopted to rear them, I have every reason to believe they could have been saved. It would be interesting to learn if any member has heard of such another case, i.e., seven tigers in one shot. The measurement of the skin is 10 feet 8 inches.

GUN CARRIAGE FACTORY, ARTHUR H. BERRIFF.
JUBBULPORE,
17th July, 1931.

[The Hon. J. W. Best also mentions a case of seven fœtuses taken from a tigress. Six, four and five have been noted, but two or three appear to be the usual number.—Eds.]

III.—OCCURRENCE OF THE PANTHER IN THE SIND DESERT

Some time back, I read in the *Times of India* that a *tiger* had been killed by villagers in the neighbourhood of Umarkōt in the Thar and Parkar District of Sind. As it seemed obvious that a panther was meant, I wrote to the Collector, Rao Bahadur Jagatsing, for details. His reply confirms the fact that a panther was killed on or about 20th February 1931 at a place near Chhōr, 6 miles from Khokhrapūr railway station. The villagers tackled the animal with hatchets and two of them were mauled in the struggle. The Mukhtiarkar, who furnished a graphic account of the incident to the Collector, says the animal measured '3 feet tall, 4½ feet long and 3½ feet in girth' (?) It is believed to have strayed in from the adjoining Jodhpur territory, and, according to the report, had destroyed 'two heads of bovine' in the Khipro taluka before it was killed.

The appearance of a panther on the edge of the Sind Desert seems an occurrence unusual enough to be worthy of being put on record.

ALIBAG, KOLABA DISTRICT, HAMID A. ALI,
2nd August, 1931. *I. C. S.*

IV.—DO LIONS STILL EXIST IN PERSIA?

(From the *Field*)

There is a general belief that the lion is now extinct in Persia and in the absence of any evidence to the contrary, one might, after a space of a number of years, come to the reasonable conclusion that such is the case.

In one of his books, Sir Percy Sykes somewhere mentions having seen the carcase of a lion floating down the Karun River. That must have been a number of years before the War. Also in

Amurath to Amurath, the late Miss Gertrude Bell mentions a pair of live lions which she saw in Baghdad, and which had been caught in the swamps of Amarah.

In the course of two prolonged motor journeys through Persia during the past five years, the writer made numerous enquiries without being able to obtain any definite information on the subject. Those Persians who might have known something about it all declared that they had never heard of a lion having been seen for many years.

There was a reported case of the skin of a lion having been brought into Barfarush by a native trapper. An Englishman who saw the skin said it looked like that of a lioness, but he could not be certain about it, and the skin was purchased as a curiosity by the Soviet Consul.

Last year, however, fresh light was thrown on the subject by another Englishman, an engineer on the railway construction work in south-west Persia. According to this gentleman, a party of American engineers had come out to inspect the work which at that time was in progress in the wild and mountainous region around Dizful. Some of the party strolled out one morning to look at the line, and they came across a pair of full-grown lions. The animals showed no fear, and the party being without any weapons beat a retreat back to camp. The lions were not seen again.

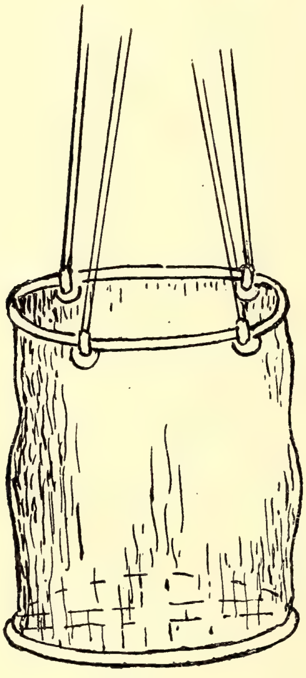
The above would seem to be definite evidence that lions do still exist in Persia, and if one pair were seen, the presumption is that there may be many more in these wild hilly tracts of the south-west of Persia.

RONALD SINCLAIR, F.R.G.S.

LONDON, S.W. 7.

V.—A USEFUL TYPE OF MACHAN.

(*With a diagram.*)



The accompanying sketch is of a *machan* I have used with great success for years. Its good qualities are: (1) it can be put up very quickly by one coolie, with hardly any noise; (2) the shikari if dissatisfied with his post can change to a higher or lower or more open position by moving the ropes which fasten the bag; (3) any movements in the bag are noiseless. The mouth of the bag should be constructed with an iron or strong bamboo ring. All the iron work should be covered with sacking, lest the gun barrel, striking the ring, sound a note of warning to any game that may be near.

In moving the bag, only one rope should be moved at a time. The supporting ropes should be tested before being tied to the ring. The wood flooring in the bag should be strong and covered with sacking so as to silence any foot movements.

DYKE, ETHORPE CRESCENT,
GERRARD'S CROSS, BUCKS,
September 1, 1931.

W. FORSYTH.

VI.—DO WILD DOGS HUNT AND KILL BY NIGHT ?

I believe that wild dogs do not usually hunt by night. They may do so under stress of hunger or on nights when there is a good moon. I am of opinion that their powers of sight would be less keen by night. Wild dogs follow deer calls but whether they do so by night is a doubtful question. I should be glad to hear the views of other sportsmen.

August 15, 1931.

RAMANUJ OF SURGUJA.

VII.—THE MALAY BEAR.

(*With a photo.*)

In vol. xxxiv, No. 3, you publish an illustration of a Malay Bear (*Ursus malayanus*). I enclose another photograph of one shot by a sepoy of the 4th Assam Rifles in the Manipur State, about longitude 93·25′ and latitude 25·7′. It was an old female, with broken teeth. Unfortunately, I did not take the measurements, but she was certainly less than 4½ feet long.

This bear is distributed throughout the hills of the State, but is not common. During the seven years I was on foreign service in the State (1910–17), I paid rewards for the destruction of 1,389 bears, and, speaking from memory, I should say that not more than 1 per cent. of these were of this species.

During the three years I was in Nowgong (Assam), which is slightly further west than the Manipur State, I only came across one Malay Bear. Some Mikirs brought in what they claimed to be a 'black tiger,' for the reward. This proved to be a full-grown Malay Bear. But my classification of the animal as a bear was received with polite derision by the Mikirs, who said that they were perfectly familiar with the bear and that this was certainly not one. Their familiarity with the bear is undoubted as there are few Mikir villages which do not contain at least one unfortunate who has been mauled by a bear. But their claim that it was a tiger was largely influenced by the fact that the reward for a bear was only Rs. 5, whereas the reward for a half-grown tiger was Rs. 12–8. They stoutly refused to be convinced, until the argument was closed by my Head Clerk, with the words, 'The Sahib says it is a bear, so it is a bear.'

THE RESIDENCY,
IMPHAL MANIPUR STATE,
19th July, 1931.

J. C. HIGGINS,
I. C. S.

VIII.—BLACK FOUR-HORNED ANTELOPE (*TETRACEROS QUADRICORNIS.*)

A melanistic example of the Four-horned Antelope was shot by Maharaj Kumar Chandikeshwar Saran Singh Deo, second son of the Maharaja of Surguja. The antelope had the colouring of an adult Black Buck. It was shot 14 miles west from the capital town Ambikapur at about twilight. There were evidently a pair and as its little horn could not be distinguished in the bad light, it was fired at and killed. Unfortunately it proved to be a female, but its mate had the normal colouring of the species. I regret that I was unable to secure a photo of this unique specimen.

RAMANUJ OF SURGUJA.

SURGUJA STATE,
CENTRAL PROVINCES.

IX.—ROGUE ELEPHANTS IN THE KHASI HILLS.

In the Khasi and Jaintia Hills, there are always one or two solitary 'rogue' elephants and not long ago in the Jirang State there were several of them. The local cultivators suffered heavily from the unwelcome and repeated visits of these animals. About the close of the last year two such dangerous 'rogues' were proclaimed and one of them was shot by me. This animal had lost its tail with the exception of a short stump left to indicate its position. On its left side alone, as it laid down dead, I counted some seventeen partially-healed-up wounds, which swelled out about 1½″ to 2″ from the body. On opening out a few of them a thick and sticky matter came out. These were no doubt the marks left on him of the shots dealt by the cultivators during his visits to their cultivations. On the inner side of its right foreleg, there was a big abscess about a foot in diameter with plenty of maggots in it. It is not understood as to how it got that wound though undoubtedly it was the one which nettled its temper most.

This animal during some months previous to its death had become a perfect terror to the neighbourhood, chasing people, robbing paddy from the fields and barns in the Umsaw and other adjacent villages, and, on the evening previous to its death, went close to the village of Mawlein where it attacked a 'Khuti-walla's' shed, drove out the buffaloes and their keepers, and killed one calf by goring it with its tusk. The rogue had a good drink of whey kept in a wooden barrel and upset the barrel when it no longer wanted it. Then it went to have a taste of *ghee* kept in kerosine oil tins but finding it not to its liking knocked down the tins and their contents and, before leaving the place, pulled down the shed and trampled over it.

On the following day, I tracked this animal from the last scene of his depredations and within a mile in the forest suddenly heard the shrill alarm raised by it. By the time I knew whence the sound proceeded, the big rogue was advancing towards me with the speed of a locomotive engine. Knowing that elephants, though they have a very keen sense of hearing and smell, have got a very poor eye-sight, I stood still (my guides had already deserted me) until the animal was only about 30 yards or so from me then I moved towards its right side, about ten yards from its direct line of advance. The animal stopped for a moment when it reached the spot where he scented or knew that I was, and during that short interval I put in one temple shot which brought him right down and there ended the career of one of the troublesome rogues of that locality.

The animal measured 10′ 8″ from the shoulder and the circumference of its fore foot was 5′ 3½″. The length of the tusks was 5′ 4″, each; the girth at their thickest portion was 17¾″ and both tipped the scale at 96 lbs.

SHILLONG, ASSAM, L. L. READE.
17th July, 1931.

X.—THE MIGRATION OF THE PARADISE FLYCATCHER

(*TCHITREA PARADISI*)

During the last two or three years a variety of articles in the *Journal* have made it very clear that our present knowledge of the migration of Indian birds is far from complete. The Bombay Natural History Society's ringing scheme has already done something, and will in the future undoubtedly do more, to increase our knowledge. But the number of species on which ringing can be practised is strictly limited, and some other method must also be adopted if we are ever to have anything like a complete knowledge of the movements of the smaller migrants.

In the past, observation on the migration of birds has largely been observation at certain specially favoured points. Observation of this type has produced such books as Gatke's 'Heligoland', and Eagle Clarke's 'Studies in Bird Migration'. The information that has been obtained in that way is very valuable, but there is another method of approaching the subject which has the great advantage that it begins with the assumption that the problems of migration may differ considerably in different species. That method is to collect all possible records of migration, species by species. An illustration of that method is to be found in Mr. Hugh Whistler's article 'The Migration of the Pied Crested Cuckoo (*Clamator jacobinus*)'. (*J.B.N.H.S.*, vol. xxxiii, pp. 136 to 145).

The purposes of the present article are (1) to point out some of the contradictory statements that have been made about the migration of the Paradise Flycatcher (*Tchitrea paradisi*); (2) to record the small amount of information the writer has been able to record on the subject from his own observation; and (3) to endeavour to interest members of the Society in helping by their observations to clear up the status of this very familiar bird.

All that the *Fauna of British India* (Second Edition) has to say about the subject is—'The Paradise Flycatcher is a resident bird wherever found, but moves about locally in parts of its habitat, probably on account of food-conditions.' (*Fauna of British India:* Birds, vol. ii, p. 267). Similar statements are made in the '*Fauna*' about several other species, but, as no definition is given of the difference between 'migration' and 'local movement', they are not very helpful.

In 'Nests and Eggs of Indian Birds', (Second Edition, vol. ii, pp. 22–26), it is stated that this species breeds 'Throughout the exterior ranges of the Himalayas up to an elevation of 5,500 feet: at any rate from Nepal to Afghanistan', also at Almora, Kotegurh, the Sutlej Valley, Sooltanpoor, and the Valley of the Beas, and Kashmir it is common.' Other places where, according to the same book, the species has been recorded as breeding, are the Doon, Terai, northern portions of Rohilcund and Oudh, wooded portions of Jhansi, Saugor, Nimar, Raipur,' and 'doubtless other portions of the Central Provinces', also the Agrore Valley, Barreilly, Calcutta Botanical Gardens, Delhi, Murree, Kashmir, Rajputana, Baroda, Mysore and Ceylon.

Whistler states ('Popular Handbook of Indian Birds', pp. 99, 100):—'Very little is known of the status and habits of this common and widely-spread bird, but it is undoubtedly migratory to a large extent. In the North-Western Himalayas and Salt Range, it is a summer visitor, only arriving about March and April and departing about September: while in most of the Punjab it is only a passage migrant in those months. To Sind it is a scarce winter visitor; while in many localities it is undoubtedly a resident.'

Since the first and third of the above summaries are mutually contradictory, and the second, which does not in the main deal with migration, certainly does not support the first, it will be well to collect a number of observations on the bird in various districts.

Beginning from the north-west, Capt. R. H. Rattray, writing of the species at Kohat, states: 'This bird breeds here fairly plentifully'. (*J.B.N.H.S.*, vol. x, p. 628).

The following note on the status of the Paradise Flycatcher at Peshawar occurs in vol. xxxii of the *Journal* (p. 750): 'A few breed in the Valley, as Briggs found a female feeding three young in trees overhanging the Grand Trunk Road, eight miles east of Peshawar on June 20, 1923. It is, however, a passage migrant in spring and autumn. Briggs states that they pass through in large numbers, but appear to stop only one day. That day falls, as far as his observations go, between April 23 and 29 in the spring, and between September 19 and 29 in the autumn. The race has not been identified.'

In 'Notes on the Birds of Thandiani' (*J.B.N.H.S.*, vol. xviii, p. 290), Major H. A. F. Magrath states: 'On July 9, I saw a female Paradise Flycatcher hawking dragonflies near the waterfalls on the Sufed Pani stream above Kala Pani.' In July 1921, I saw an adult male of the species between the falls mentioned above and Thandiani. It was the only occasion on which I saw the species in that neighbourhood.

I have found the species breeding in considerable numbers near Murree, chiefly about 5,000 feet.

In Kashmir the Paradise Flycatcher is one of the most familiar birds in the summer.

Whistler states (*J.B.N.H.S.*, vol. xxviii, p. 997): 'Except for an adult male seen on April 6, no Paradise Flycatcher was seen until April 14. After that date the species was common about Srinagar till my departure and I saw several about the road on my downward journey.'

Referring also to Kashmir B. B. Osmasten states (*J. B. N. H. S.*, vol. xxxi, p. 988) that the species is common in the Vale of Kashmir in summer, ascending the hills to about 6,000 feet; that it arrives about the middle of April, leaves about the middle of October, and breeds in May and June.

Whistler states that the species is common in the Kulu Valley up to a height of about 5,000 ft. adding: '...of course only as a summer visitor.'

Leaving the hills for the plains of the Punjab, we find that Dewar states that the species 'visits the Punjab in great numbers in summer for nesting purposes'; (Indian Birds, p. 124); and that 'in Lahore this species nests in considerable numbers along the well-wooded banks of the Ravi.'

The following is a quotation from 'A Contribution to the Ornithology of Delhi' (*J. B. N. H. S.*, vol. xxxi, p. 268), by S. Basil-Edwardes: '*Terpsiphone paradisi paradisi* (L)(The Indian Paradise Flycatcher). I did not see this species, and it had not arrived before I left Delhi. (Eggs taken by Bingham. Seven nests on May 27, and June 12.')

F. Field, writing of the Gonda District, U. P., and referring to the breeding of the species, says:—'In forests and plains, but more common in forests. May, June.' (*J.B.N.H.S.*, vol. xxviii, p. 757.)

In an article entitled 'A Description of the Nests and Eggs of the Common Birds occurring in the Plains of the United Provinces', (*J. B. N. H. S.*, vol. xxix, p. 343), E. H. N. Gill states: 'During the winter months this attractive bird occurs in most districts and is frequently met with in gardens and groves adjoining human dwellings. Unfortunately, the bulk seem to migrate in summer to the Sub-Himalayan tracts, but a great many remain behind and breed sparingly throughout the plains. I have found eggs as regularly in the Eastern as in the Western Districts.'

In the Ghazipur District of the U. P., the species appears to occur as a passage migrant and a summer visitor. Perhaps a rains visitor would be a better description, as they do not seem to be established till the middle of June. In 1930 all seemed to have left by September 17, but on October 3 and 13, single birds were seen, and a pair on October 17. This year (1931), from the middle of April till the middle of June, occasional birds were seen, often with a gap of several days when none were to be seen. Presumably these were passage migrants, as I believe those seen in October last year were.

In 'Birds of an Indian Garden' by T. Bainbridge Fletcher and C. M. Inglis, (p. 60), the following note on the species in Bihar occurs: 'In North Bihar,......it arrives about the end of March and leaves at the end of October, not being noticed during the cold weather. It is fairly common locally in Bihar, but its distribution seems to be rather erratic: for example, I have never seen one at Pusa.'

In the neighbourhood of Mhow (Central India), the Paradise Flycatcher breeds in the Vindhya Hills, and occurs on the Malwa Plateau as a passage migrant. Whether it is resident in the Vindhya Hills or only a summer visitor I am uncertain, but I did not observe it there between October 12 and March 27.

Cunningham, in 'Some Indian Friends and Acquaintances,' (p. 123), says of this species:—'They are not very common inmates of gardens about Calcutta, but stray specimens may be met with at almost every time of the year, and, at the beginning of summer, small parties of them, apparently in quest of good sites for nests, often visit quiet areas, such as those afforded by the more secluded parts of the Botanic Gardens. Such parties include birds of both sexes, some of the males being in all the splendour of fully developed trains and mature black and white colouring, whilst others have trains of chestnut or are still feathered like the females. At all other times of the year it is very rare to see any but short-tailed, chestnut and black birds.

'Eha' states ('The Common Birds of Bombay', p. 77 '......everybody who has roamed about Matheran or Mahableshwar must be familiar with it, but I dare say some will be surprised to hear that it is a Bombay bird.......I believe that the Paradise Flycatcher only visits us for a short time during the cold season. I have never heard of its nest being found on this island.'

Lastly, Mr. George Brown includes this species in a list of birds seen on a trip from Pottuvil to Kumna, Ceylon, between April 10 and 21. (*J.B.N.H.S.*, vol. xxxiv, pp. 815 ff.)

From the above extracts it would appear that, far from being 'a resident bird wherever found', (*Fauna*), it is mainly, if not entirely, a migratory species. Its breeding area, however, does not seem to have been very clearly defined so far, and its winter quarters seem still more vague. In addition to this there are certain contradictions amongst the statements quoted above.

The species appears to breed through a large part of the Himalayas at comparatively low levels. Presumably all these records refer to the sub-species *leucogaster*. South of the Himalayas they breed sparingly in the N.-W.F.P., but are recorded only near Lahore in the Punjab. They have been recorded as breeding at Delhi, and are regular breeders in the United Provinces. As it is recorded as a summer visitor to parts of Bihar, it is fair to assume that it breeds there. 'Nests and eggs' records it as having bred in the Botanical Gardens, Calcutta, but Cunningham's references to the species appear to point it out as mainly a passage migrant at Calcutta. Further south it appears to breed in various parts of the hilly country of Central India. It is also reported as breeding in Rajputana, Baroda and Mysore.

Referring to the winter area of the species only two places are mentioned—Sind and Bombay. Whether 'Eha's' reference is meant to apply only to Bombay or whether it also applies to Mahableshwar and Matheran is uncertain. [1]

The only contradictory statements that need to be mentioned here are those of Mr. Gill and myself. It would be interesting to know to what districts of the U. P. the former is referring. In the Ghazipur, Benares, and Azamgarh Districts, the Paradise Flycatcher certainly does not occur in the winter, and I have been told by reliable observers that the same is true of the Fyzabad District. What makes Mr. Gill's statement more surprising is that he spent some time in the Ghazipur District. Is it possible that in some years the species winters in the United Provinces and that in other years it does not ?

In any case, enough has probably been said to prove that our present knowledge of the species is far from complete. If every member of the Bombay Natural History Society would note the status of the Paradise Flycatcher in his own area and send that information to someone capable of dealing with it, more might be learned of its movements. The same is true of many other familiar species, but the Paradise Flycatcher is a good bird to begin on, because it is so conspicuous that it cannot be overlooked. Unless someone better qualified is prepared to undertake the task of collating such information as may come to hand in that way, I am quite ready to do so myself, and shall be grateful to anyone who will correspond with me on the subject. One point to be noticed is that, although the distribution of the Paradise Flycatcher is given as the whole of India, there seems to be a great paucity of information from the south. A second point is that, although sub-specific identifications are useful, notes are also useful where the sub-species is doubtful, and that sub-specific identifications which are not supported by specimens are more likely to increase than to clear up the present vagueness of our knowledge of the status of the species.

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[1] 'Eha's' reference applies, we believe, to Bombay where the Paradise Flycatcher has been observed occasionally during the cold weather. It has been noted in Bandra, at the foot of Trombay and in the wooded portions of Salsette during this time of the year. In Matheran and Mahableshwar, the Paradise Flycatcher is common during the cold weather and less so during April, May, though young birds have been observed during the hot season.—EDS.

WESLEYAN MISSION,
GHAZIPUR, U. P.,
July, 1931.

F. S. BRIGGS.

XI.—SEX DIFFERENCES IN THE MIGRATION OF THE COMMON TEAL (*NETTION CRECA*)

It may interest you to know that while I was in Kashmir between January and February, 1930, I shot a considerable number of Common Teal. All of them with one exception were drakes. I believe that it has been noticed by other observers that the females of the Common Teal are in a large majority in early winter and later their places are taken almost entirely by drakes. This was certainly borne out by my observation.

PORTLAND PARK,
ALIPUR, CALCUTTA,
July 20, 1931.

M. D. N. WYATT.

[Differences in migration behaviour related to sex and age have frequently come under notice. Gatke from his observations of the movements of birds at Heligoland held that adult males tended to be later in migration than the females. His view seems to be supported by the observations of Mr. Wyatt and others in reference to the autumn migration of the Common Teal into India. The behaviour of migrating birds must vary in different species and no general rule can be laid down without further confirmation.—EDS.]

XII.—NOTES ON THE NESTING HABITS OF THE RED-VENTED BULBUL (*MOLPASTES CAFER*).

A pair of these birds built their nest and brought up three young just opposite the front door of a friend of mine, in the heart of the city. I. R. drew my attention to the nest, and we both watched the parent birds for a considerable time feeding their young. One interesting point resulted from our observations. It is a well-known fact that the nests of birds are seldom soiled by the excreta of the young. This cleanliness is generally attributed to the fact that the young either excrete in such a way so as to ' shoot ' the excrements beyond the limits of the nest, a very common thing with the Birds of Prey, for example, or, the parent birds are responsible for cleaning the nest when leaving it after feeding the young. In the former case the excreta of the young is usually in a very liquid state, but in the latter the excreta is generally enveloped in a thin tenacious film which is not easily punctured. This facilitates its removal from the nest.

To return to the birds under observation, we noticed that in this case, at least, that each time the parents fed one of the young, they would immediately go round to the nether end and wait for it to excrete. It is well known that as soon as nestlings are fed, they excrete immediately after. In the present instance it was observed that each time the young excreted, the parent birds would take hold of the excreta as it emerged and swallow it. This procedure was repeated each time the young were fed. Here arises a question. Why should the parent birds swallow the excreta ? In domestic animals, such as the dog and the cat, it is common knowledge that the mother eats the afterbirth and other secretions at the time of birth and later on cleans up both the excreta and the urine of the young. Is it possible that in such cases the reason for such a habit serves only as a means of keeping the nest or lair clean or, is it that there still remains in the excretions of the young a certain amount of undigested nourishment which helps also to nourish the parent ? For at the time when animals are burdened with young, they appear to have little time for feeding themselves, being occupied the greater part of that time either in protecting or feeding the young. In the case of birds it seems as though the parents have little time to obtain a sufficient supply of food for themselves when they are burdened with young. The parent birds are seen going to and fro all day from the nest and one wonders what time they have to feed themselves. They can only bring one insect at a time, and young birds take a lot of feeding. Therefore it does seem possible that the parents do derive a certain amount of nourishment from the excreta of their young which is in all probability only partially digested.

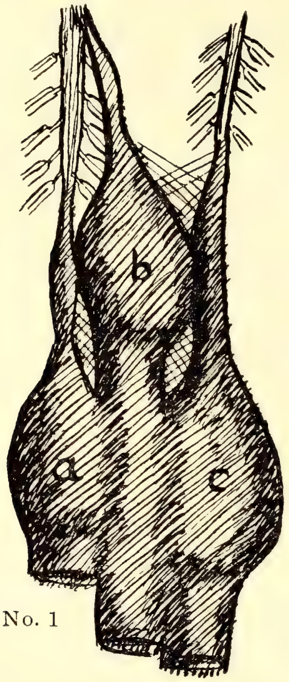
Another point of interest is that though the nest was in a most exposed situation, these little birds were able to hold their own against the crows that infested the locality. No crows were permitted to come within a certain distance of the nest. If they did they were immediately attacked, the bulbuls' rapid movements were too much for the crows, forcing them to beat a hasty retreat. It seemed strange that despite the great difference in size, the crows would not make a stand to defend themselves but would only fly out of the area.

BOMBAY NATURAL HISTORY SOCIETY, C. McCANN, F.L.S.,
BOMBAY, *Assistant Curator.*
September 30, 1931.

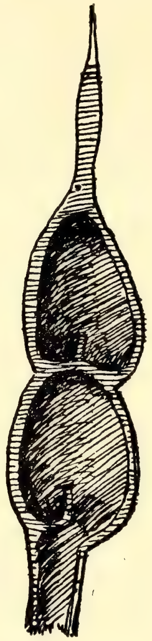
XIII.—DOUBLE NESTS OF THE WEAVER BIRD (*PLOCEUS PHILIPPINUS*).

(*With a diagram*).

In *Miscellanea Zoologica Sumatrana*, lvii, Mr. J. C. Van der Meer Mohr in a note on the nesting habits of the Malay Weaver Finch (*Ploceus passerinus infortunatus*) describes examples of ' double nests ' of this bird secured by him in Sumatra. The writer illustrates three types of these peculiar nests—



No. 1



No. 2

1. A new complete nest built under and closing the entrance to the egg-chamber of an old nest, left over from the previous season.
2. Two nests built and woven together side by side.
3. Is a variation of No. 1—four nests 'storied' one above the other.

The note has drawn my attention to very similar nests built by the Indian Weaver Bird (*Ploceus philippinus*). These nests were collected at Indore and presented to the Society by Mr. Mears. The figures on page 682 give an indication of their structure:

No. 1 illustrates three connected nests, *a*, *b*, and *c*.

a and *b* are suspended from the same palm leaf; *a* from its extremity; *b* from about 1′ higher; *c* from a neighbouring leaf. *a* is an incomplete nest without its entrance tube, its egg chamber is solidly interwoven with the entrance tube of *b*, while its upper portion is loosely attached. *b* is a complete nest. Its solid upper portion measures 10″, the egg-chamber 7″ and the entrance tube 16″. *c* is a complete nest with a short entrance tube. Its egg-chamber and tube are closely woven to the entrance tube of *b* while the attachment of its upper portion is rudimentary. It will be seen that Nest No. 1, from Indore, corresponds to type 2 taken in Sumatra, *i.e.*, two nests joined side by side.

Nest No. 2 follows type 1 from Sumatra, *i.e.*, a complete nest built under and closing the entrance to an incomplete nest above it.

Whether these nests were the work of the same cock or not, it is impossible to say.

Mr. E. G. Herbert in his paper on the Nests and Eggs of Birds in Central Siam (*Journ. Siam Soc.*, *Nat. Hist.*, vol. vi, 1923–1926), which Mr. Van der Meer Mohr quotes, also refers to 'double' nests of Weaver Birds observed by him—in this instance a new nest built under an old one.

Mr. Cripps writing on the nesting of the Eastern Baya (*Ploceus megarhynchus*), Hume's *Nests and Eggs of Indian Birds*, second edition, vol. ii, p. 119) says: 'I have on several occasions found a second nest commenced from the bottom of the tube of the old one, the upper nest being useless as the passage is closed up.' This peculiarity in the nest building of our Weaver Birds noted by many observers may perhaps offer a clue to the origin of the great communal nests of the Social Weaver Birds (*Philœthærus socicus*) of South Africa. These wonderful nests built of grass and twigs are composed of numerous separate chambers for housing individual families. The birds do not occupy the same compartments every year, but at the return of the breeding season build new nests under the old ones. Thus the aggregated mass increase in size and may contain more than one or two hundred separate chambers. From building separate nests these Weaver Birds may have passed to the stage of joining a few nests together and in course of time was thus evolved the present gigantic structure with its common roof and its component cubicles for the housing of a few hundred families. The material used, the site and the plan of construction adopted, the circumstances and conditions under which these birds built their nests and the effective protection they obtained being the factors which directed and favoured the intenser development of the social habit and the evolution of this particular type of nest architecture as the one most beneficial to the preservation and continuity of the species.

BOMBAY NATURAL HISTORY SOCIETY. S. H. PRATER, C.M.Z.S.
6 APOLLO STREET, *Curator.*
October 15, 1931.

XIV.—PLACE OF THE JAVA SPARROW (*MUNIA ORYZIVORA* L.) IN THE INDIAN AVIFAUNA.

Munia oryzivora (Linn.) attracts notice more as a cage-bird than one which, given its freedom, can thrive and readily acclimatise itself in other than its native habitat. The case of such liberated individuals is not unknown in the annals of Indian ornithology. The introduced species is looked upon as only an exotic form—an escape from the cage. Half a century ago, Blyth mentioned the occurrence of *Munia oryzivora* (Linn.) in the Mergui Province (Burma). Jerdon, Hume and Oates found the bird common enough and nesting wild near Madras. Legge recorded its acclimatisation in Ceylon. A species which had to its credit a record of successes in introducing and maintaining its hold in new situations and under varying circumstances in many parts of China, Japan, Siam, Cochin China, the

Malay Archipelago, Mauritius, the Zanzibar Coast and other localities, would naturally raise high hopes in the mind of Oates as regards its rapid multiplication in the jungles of British Burma. The problem arises what would *now* be the status of *Munia oryzivora* (Linn.) in relation to India's native avifauna ? Will the success of its introduction or the extent at its present stage of its naturalisation in this country warrant its inclusion in the permanent list of the Indian avifauna ? Oates who edited the first edition of *F.B.I.* (Birds) was merely content with an allusion to this bird in a foot-note. Apparently it was premature then to take for granted its Indian domicile. Almost half a century has since gone by. From published records during this period one finds hardly any light on its movements. A new edition of *F.B.I.* (Birds) has been called forth, and in it, unhappily for *Munia oryzivora* (Linn.), Mr. Stuart Baker has not a word to say, nay, he has thought fit to delete even the former foot-note of Oates. Has the bird then lost its foothold and failed completely in its effort to cope with Indian conditions ? The bird 'appears to be acclimatised near Madras', writes Mr. W. E. Wait in 1925 in his *Manual of Birds of Ceylon*, though round Colombo it seems to him not quite as flourishing as in Legge's time. Very recently near Calcutta (10 miles to its north), I have under observation a colony of these Munias whose favourite resort is a shrubby situation composed of two or three trees embracing each other and overhanging the paddy-stacks put up in the compound of some villagers close to Agarpara railway station (Dist. 24-Parganas). These have not only food within easy reach but also cover and shelter from the hot sun and driving rain. Their hunting ground in the early morning is the surrounding paddy-fields (from which paddy and straw have been removed), where flocks of considerable size will descend and feed on fallen paddy. Their chirrups are now incessantly heard and enliven the country-side. They feed here till about 8 o'clock when they retire to their cover and roost, returning towards afternoon to search for paddy. Wary to a degree, they will, on the least suspicion of danger, hurry away to distant directions, some sheltering themselves in tree-tops and some in thickets and impenetrable reed-beds within *jheels*. Once I found while a bird-catcher spread his net to capture them, the birds on the paddy-fields would keep clear of the trap. Frightened birds while seeking cover among trees will so adjust themselves that one tries in vain to look for them in the self-same tree into which they slip into complete oblivion. Evidently these birds suffer little molestation from the local people, for they will allow me to watch them at close quarters. Great are their chances of persecution, as they are much sought after as cage-birds on account of their pretty colour and attractive qualities, and they enjoy hardly any protection under the legislation of the country. They are quite hardy birds and possessed, as they are, with powerful beaks and no inconsiderable power of flight, apparently run little risk of getting worsted in the struggle for existence. Sparrows will dare not bully them. Rather both will tolerate each other, roosting and feeding in each other's company. I have not yet been able to find out the nesting site of the Munias, but I suspect it lies within the belt of almost impenetrable reeds not far off from their roosting place. The under-noted measurements are those of three specimens which I could manage, with the aid of a bird-catcher, to snare with bird-lime :—

Locality.	Date.	Wing.	Tail.	Tarsus.	Culmen.
Agarpara	30—1—31	67	47	19	18 mm.
Do.	31—1—31	66	46	18·5	17 mm.
Do.	1—2—31	69	47	19	17 mm.

So little is known about *Munia oryzivora* (L.) introduced into various parts of our country. There is no published record of its occurrence in Bengal. Yet the bird has had some success in its efforts to adjust itself to situations and circumstances unfamiliar to it. Will not this success claim for it a place among India's avifauna? The problem, fascinating as it is, admits of solution by closer observation and concerted effort of the ornithologists in this country.

50, Kailas Bose Street, SATYA CHURN LAW.
Calcutta,
July 29, 1931.

[In an issue of the *Girl Guides' Magazine,* 1928, under Nature Notes, there is a record of a pair of Java Sparrows nesting near Poona.]

XV.—NOTE ON THE BREEDING OF THE INDIAN MOORHEN (*GALLINULA CHLOROPUS PARVIFRONS*).

Sir,

In his article on the Indian Moorhen (*Gallinula chloropus parvifrons*) in the *Journal,* vol. xxxi, p. 542, Mr. Stuart Baker writes, *à propos* of its nesting, 'Hume seemed to think that they had two broods in the year in the hills, laying first in May and again in the latter half of July but other observers think they have only one set of eggs in the season'. It may be of interest to know that Hume was right, though a little out as to the times of laying.

There is in my garden a large tank, nearly 100 yards square, in the middle of which is a small island, covered and surrounded by a bed of reeds, on which are three or four trees growing. In the tank are several broad belts of white lotus, and there is a certain quantity of water weed of various kinds. The surroundings are quiet and the tank is a sanctuary, which is visited by a number of water birds. Major-General Sir James Johnstone, who was Political Agent fifty years ago, has recorded that geese were to be seen there in his time, and I have seen nine varieties of duck on the tank. Frequently one or two pairs of Whistling Teal (*Dendrocycna javanica*) breed on the island.

For some years past a pair of moorhens have yearly brought up a family on the tank. Though I have sometimes noticed a late brood, I have never actually seen two in a season, and always thought that a late family denoted the failure of a first brood. But this year I noticed the pair with two young ones (I subsequently saw a third), nearly as large as mynas on May 7. These young birds, now practically as large as the parents, are still on the tank. The day before yesterday I found the hen feeding on the lotus leaves near the bank of the tank. She was very agitated when she saw me, and ran over the leaves in the direction of the island, making the call which I have learnt to associate with the collection of her young. I watched, and saw three minute chicks, in black down, running over the leaves after her. Eventually they took to the water and all reached the shelter of the reeds.

Apart from young birds, I have never seen more than one pair of moorhens on the tank: I know of no water within half a mile of this tank where moorhens are to be found. I think there can be no doubt that the same pair of moorhens have brought off two broods, hatched (not laid) in late April and late July.

THE RESIDENCY, IMPHAL, J. C. HIGGINS, I.C.S.
MANIPUR STATE,
July 28, 1931.

[Subsequent to the receipt of the above note Mr. Higgins, in a letter to the Society, says: ' In continuation of my letter of July 28, on the subject of the Indian Moorhen (*Gallinula chloropus*), I may say that the second brood consisted of six, not three. I have seen the chicks several times, escorted sometimes by a parent, sometimes by one of the first brood, running about on the lotus leaves.

' On the 10th instant I saw one of the Whistling Teal (*Dendrocycna javanica*) on the tank escorting three very small ducklings about the lotus leaves.'—EDS.]

XVI.—DESCRIPTION OF THE IMMATURE PLUMAGE OF THE INDIAN PRATINCOLE OR SWALLOW PLOVER (*GLAREOLA M. MALDIVARUM*).

We are greatly indebted to Mr. C. F. Jeffery, State Engineer, Manipur, Assam, for the above mentioned specimen, a description of which has not been recorded in the new *Fauna of British India*, Birds.

Forehead, crown and nape dark brown, the feathers faintly edged with buff; a well-defined supercilium creamy buff streaked with brown; whole upper plumage except rump brown, the feathers edged with buff forming crescents on the scapulars, wing coverts and lower back. Rump pure white; tail feathers blackish brown with broad white bases; tipped buff. First three primaries blackish brown; the remainder edged creamy white. Auxillaries and under-wing coverts rusty red. Chin and throat white, the sides of the neck streaked with brown forming an irregular gorget on the upper breast. Lower plumage white flanked grey.

Bill and feet black.

BOMBAY NAT. HIST. SOCIETY, V. S. LAPERSONNE, M.B.O.U.
APOLLO STREET, BOMBAY,
September 30, 1930.

XVII—EARLY ARRIVAL OF FANTAIL SNIPE (*GALLINAGO GALLINAGO*) IN MANIPUR.

It may be of interest to record that I shot a Fantail Snipe (*Gallinago gallinago*) this morning. The earliest date on which one is known to have been shot previously in Manipur is August 24. Including this one, only 11 have been shot in August in the past 20 years.

Our earliest record for the Pintail Snipe (*Gallinago stenura*) is August 2, 1930, when one was shot by Capt. G. F. Bulfield of the 216th Gurkha Rifles.

THE RESIDENCY, IMPHAL, J. C. HIGGINS, I.C.S.
MANIPUR STATE,
August 16, 1931.

XVIII.—THE DISTRIBUTION OF THE EASTERN GREY DUCK (*ANAS PŒCILORYNCHA ZONORYNCHA*).

I note Mr. Higgins' remarks, in vol. xvvv, No. *2* of the *Journal,* on a letter of mine about the first Indian record of the Eastern Grey Duck (*Anas pœcilorhyncha zonorhyncha*).

If he will turn to Mr. Stuart Baker's *Game Birds of India, Burma and Ceylon*, vol. i, '*Ducks and their Allies*', he will find that the birds got by Messrs. Moore and Mundy and others in Assam and Burma (with the exception of the two *zonorhyncha* mentioned by me) etc., were the Burmese Grey Duck (*Anas pœcilorhyncha haringtoni*) a quite different bird with a blue and not a green speculum. In the *Fauna of British India, 2nd edition*, vol. vi, under '*Anas zonorhyncha*' is the following note on distribution:—'There is one specimen from Kentung, Southern Shan States, in the British Museum collection, whilst Harington also shot one at Taungyi, Burma, in December 1911.' In vol. viii, p. 702, of the same work Stuart Baker writes: 'Inglis obtained a typical specimen of this duck in Behar, an extraordinary extension of its range.'

MUSEUM HOUSE, DARJEELING, CHAS. M. INGLIS,
October 30, 1931. F.Z.S., F.E.S., E.M.B.O.U.

XIX.—THE STIFF-TAILED DUCK (*ERISMATURA LEUCOCEPHALA*).

I was very interested in Captain Whitehead's article on the Stiff-Tail in vol. xxxv.

I relate the following as rather an unusual occurrence. Early this June, during a furious dust storm, I noticed a solitary duck on the reservoir that contains the Peshawar water-supply. As this is a strange resting-place for duck in June, I was determined to identify the intruder, so had it put up and shot it as it came round. It was a Stiff-Tail.

BARA FORT (N.-W.F.P.),
August 4, 1931.

M. G. DE L'ISLE STURM,
Captain, Royal Army Medical Corps.

XX.—FLYING FROGS.

I was interested in the note entitled 'A Flying Frog' at page 220 of the *Journal*, vol. xxxv.

I first saw a very similar frog shortly after my arrival in Rangoon at the end of 1930. It lived in our drawing room for many days, being usually seen on the wall or side of a piece of furniture. It appeared quite fearless of humans and jumped freely, giving the impression of never looking before it leapt, but always arriving safely at some unlooked for destination. At night it hid in a pigeon hole of the writing table.

We left that particular house about that time so I do not know what became of it.

Some weeks later when driving my car it showed symptoms of serious misfiring. On opening the bonnet I found a 'flying frog' gripping the steering column and very near the distributor. I removed him gently but firmly and the car ran perfectly, so I can only presume it was causing a 'short' somewhere.

A few days later, another, or possibly the same flying frog was found in the porch of our new and present bungalow. As the car always stands in the porch perhaps it was heading for the engine. It was personally conducted by my driver among the shrubs and plants of the front garden which it reached by a series of half-hearted bounds.

Two days ago another such frog was discovered in a bathroom, on the first floor, hiding behind a curtain. This was definitely a smaller specimen with black mottled markings on its back and flanks, and a distinctly more pointed snout than the illustration in your *Journal*.

I took it downstairs and it disappeared. I have not seen these frogs fly but should imagine they could glide some distance. I have never seen them feed, but fancy their diet must be similar to that of lizards, as they live the same kind of life.

RANGOON,
September 18, 1931.

J. G. P. DRUMMOND,
Major.

XXI.—CASE OF RECOVERY FROM THE BITE OF A PHOORSA (*ECHIS CARINATA*).

The patient passed over shellfish shingle in the compound to look out for a ship at 4–45 a.m. at Marmagoa on Saturday, May 30. Was bitten in the left foot as he returned to the house, but thought it must have been a scorpion as snakes are not expected on the shingle.

Sent a note at 6–30 a.m. asking for a doctor to be sent, meanwhile painted the punctures with Iodine.

A *mantra* man was seen at 7 a.m. who stated that it was a bite by the snake known as a Phoorsa, and commenced the usual treatment.

At 8 a.m. the doctor arrived and since the man was treating the foot he agreed to let him carry on although he had brought an injection of gold chloride. He left, and asked for a report in the evening. The foot was now swelling considerably and turning colour.

From the time of the bite up to 9 a.m. the patient fainted, and again several times nearly fainted. Was given brandy.

Another doctor came in the evening and as the leg was very much swollen and discolored and the blood pressure low, he called in another doctor. The mantra treatment continued with a last application at 6–30 p.m.

The patient passed a bad night on Saturday and in the morning on examination by the doctor the urine was thick and blood coloured, the blood pressure worse and temperature sub-normal.

Sunday, June 1.—Passed a bad night. The leg was still swelling and extending, dark blue patches appearing on different parts of the body. The doctor applied leeches. The mantra treatment was continued. There was excessive bleeding from the wounds. The patient passed a bad night. Condition low.

Monday, June 2.—More dark-blue coloured patches appeared on the arms and body. The blood pressure was unsatisfactory, so another doctor was summoned. At noon the patient was very low, there was excessive bleeding from the wounds, also from the centres of the patches, which had the appearance of the top of a pepper castor. The surgeon from the Hospicio Hospital (Dr. Dias) at Margoa was then called. Margoa is about 20 miles from Marmagoa. He arrived at 3 p.m. and immediately cauterised the whole of the flesh from the toe and well around the place of the bite with a blow lamp and instrument. He injected a full dose of polyvalent anti-venine as no other was available and removed the patient to the hospital 20 miles away, by car. On arrival the whole of the leg was placed in cotton wool and douches of Mag. Sulph. lotion applied day and night for about 10 days (anti-gangrene treatment) and a local lotion applied to the wound. Nothing but black coffee was given to the patient. After four days the patient was allowed a little milk. The leg re-acted to the treatment, the patches on the body and the whole of the leg faded somewhat. Another injection of anti-venine was given on Tuesday and one on Wednesday, June 3, after which the whole of the discolorations faded, those on the body fairly rapidly. Except for a few hours after each of the injections, the temperature of the patient was constantly sub-normal.

The leg slowly became reduced in size, the discolorations became less pronounced, the wounds steadily healed up and new flesh grew, covering up the exposed bone. The patient left for Bangalore on June 21 and reported to Colonel McPherson, Surgeon Superintendent of the Bowring Hospital. On arrival there, temperature was 97° and condition low. Internal medicine was prescribed and the leg had to be kept at rest. The patient has since recovered in general health, but the final healing of the wound is slow, and the foot still discolours on being subjected to pressure.

The gold chloride was not injected.

Bombay,
September, 1931.

W. T. E. HUFFAM.

XXII.—TREATMENT OF SNAKE BITE

We have been interested in the treatment of the bites of the American poisonous snakes and during the last four years, the death-rate has decreased by about 100 a year. We attribute this success to—

(1) Reduction of the amount of venom absorbed by Mechanical Suction, 20 minutes an hour, 15 hours.

(2) Neutralizing the venom in the circulation with anti-venine (a polyvalent serum) in repeated doses until neurotoxic symptoms disappear.

(3) Treat shock.

(4) Replace the blood destroyed by the venom by blood transfusion, saline or glucose solutions intravenously and by protoblysis.

We have had remarkable success in serious cases by persistent treatment. We have had cases live after the pulse stopped for many hours—in the case of a soldier for 24 hours and a woman for 19 hours. We have had great success with Mechanical Suction in rattlesnake bites and use a rubber bulb made by Fleck Headrick Co., 521 North Alamo, San Antonio, Texas, in the field or an aspirator in the hospital. See 'Mechanical Treatment of Rattle Snake Venom Poisoning' by Dudley Jackson, M.D. and W. T. Harrison, Surgeon, U. S. Public Health Service, in the *Journal of the American Medical Association*, June 16, 1928 and *Treatment of Snake Bite* by Dudley Jackson, *Southern Medical Journal*, July 1929, and First Aid Treatment for Snake Bite in the *Texas State Journal of Medicine*, July 1927. I also have articles in the same numbers.

The Stables,
Naroton, Conn., U.S.A.,
July 15, 1931.

M. L. CRIMMINS,
Col., U.S. Army, Ret.

XXIII. SNAKES ON THE BARSI LIGHT RAILWAY (DECCAN).

The Barsi Light Railway extends from Miraj in the south-western corner of the Bombay Deccan to Latur in the northern part of Hyderabad, covering an area 203 miles long on the Deccan plateau between the river Kistna in the south-west and the Godavari's tributary, the Manjra in the north-east. It is throughout a fairly uniform country with an average altitude of 1,600 to 2,200 ft. With the exception of a tract north-east of Miraj, between the stations Athni Road and

Jath Road, where bare rocky ridges and truncated hills rise above the plains and a narrow strip of mountainous country between Pangri and Yedsi made up of forest-clad hills and deep ravines, the plateau is only feebly undulated. The trap rock is mostly covered by black cotton and murmad soils with here and there patches of red soil. Trees are, as a rule, scarce though the *babul* is common enough and so are *nim* trees along the roads. Stoney barren stretches and cultivated fields of *juar*, cotton and groundnuts edged by the ever-present *Opuntia* and occasional agaves and here and there a sandy nala are the main features of the tracts covered by the railway— At the sacred city of Pandharpur, where thousands of Mahrattas congregate during the fairs to worship Vithoba, the Bhima is crossed, and 40 miles further north-east near Mahisgaon, its tributary the Sina. At Kurduvadi—the headquarters of the railway, the Barsi Light and Great Indian Peninsula Railways intersect while further north-east Barsi town with its important grain market and spinning mills and Latur with its ginning and pressing factories are given an outlet for their products through the Barsi Light Railway.

In order to acquire a knowledge of the kinds of snakes present along the railway and the relative proportion of poisonous species, a bounty of 2 annas was paid for each specimen during a period of about two years.

From August 19, 1929, to November 1, 1931, a total of 458 snakes belonging to 19 different species were received at the Kurduvadi dispensary.

These are tabulated below giving a percentage of 15·7 of poisonous specimens (72 out of 458) :—

Dipsadomorphus trigonatus	103
Lycodon aulicus	95
Macropisthodon plumbicolor	40
Coluber helena	40
Naia tripudians	37
Zamenis fasciolatus	28
Eryx conicus	24
Echis carinata	23
Typhlops braminus	13
Coronella brachyura	10
Nerodia piscator	10
Ptyas mucosus	9
Bungarus cæruleus...	8
Oligodon arnensis	5
Typhlops acutus	4
Eryx jaculus	3
Callophis trimaculatus	3
Oligodon taeniolatus	2
Vipera russelli	1

Whereas a sufficiently representative number was received from Kurduvadi, only scanty specimens were forthcoming from other stations and from many of these none at all was obtained. It is however likely that all the above species, with possibly one or two exceptions, occur throughout the entire tract of land covered by the Railway.

The distribution according to localities is given below, the stations being ranged from Latur, the north-eastern terminus in the Nizam's Dominions to Miraj in the Southern Maratha country:

Latur—

Macropisthodon plumbicolor	1
Naia tripudians	1

Hangul—

Dipsadomorphus trigonatus	4
Macropisthodon plumbicolor	1
Naia tripudians	1
Oligodon arnensis	1
Oligodon tæniolatus	1

Owsa Road—

Dipsadomorphus trigonatus	2
Macropisthodon plumbicolor	2
Lycodon aulicus	1
Ptyas mucosus	1

Murud—

Dipsadomorphus trigonatus	4
Naia tripudians	2
Coluber helena	1
Bungarus cæruleus	1

Kalamb Road (*Tadvala*)—

Coluber helena	3
Lycodon aulicus	1

Pangri—

Naia tripudians	1

Barsi Town—

Macropisthodon plumbicolor	1

Shendri—

Naia tripudians	2

Chink Hill—(and neighbouring village).

Dipsadomorphus trigonatus	13
Lycodon aulicus	9
Coluber helena	6
Echis carinata	5
Macropisthodon plumbicolor	2
Zamenis fasciolatus	2
Coronella brachyura	2
Naia tripudians	1
Ptyas mucosus	1
Typhlops braminus	1
Nerodia piscator	1
Vipera russelli	1

Kurduvadi—

Lycodon aulicus	77
Dipsadomorphus trigonatus	64
Naia tripudians	27
Coluber helena	26
Macropisthodon plumbicolor	25
Eryx conicus	24
Zamenis fasciolatus	23
Echis carinata	13
Typhlops braminus	11
Coronella brachyura	8
Nerodia piscator	6
Ptyas mucosus	4
Typhlops acutus	4
Bungarus cæruleus	2
Oligodon arnensis	2
Eryx jaculus	2
Callophis trimaculatus	2
Oligodon tæniolatus	1

Padsali—

Ptyas mucosus	1

Modlimb—

Bungarus cæruleus	1

Ashti—

Dipsadomorphus trigonatus	4
Lycodon aulicus	2
Echis carinata	2
Typhlops braminus	1
Naia tripudians	1
Bungarus cæruleus	1

Pandharpur—

Lycodon aulicus	3
Dipsadomorphus trigonatus	2
Macropisthodon plumbicolor	2
Oligodon arnensis	2
Nerodia piscator	2
Coluber helena	1
Naia tripudians	1
Ptyas mucosus	1
Bungarus cæruleus	1
Eryx jaculus	1
Caliophis trimaculatus	1

Bohali—

Dipsadomorphus trigonatus	6
Macropisthodon plumbicolor	4
Coluber helena	2
Echis carinata	2
Zamenis fasciolatus	1
Bungarus cæruleus	1

Bamani—		
	Dipsadomorphus trigonatus	2
	Lycodon aulicus	1
Wasud—		
	Dipsadomorphus trigonatus	1
	Lycodon aulicus	1
	Macropisthodon plumbicolor	1
	Coluber helena	1
	Zamenis fasciolatus	1
Jath Road—		
	Bungarus cæruleus	1
Athni Road—		
	Nerodia piscotor	1
Miraj—		
	Dipsadomorphus trigonatus	1
	Ptyas mucosus	1

The seasonal distribution of the commonest species during the two years' period, August 19, 1929, to August 18, 1931, was found to be the following. The month in which the largest number of each was observed being given in the table:

Dipsadomorphus trigonatus ...	September	29
Lycodon aulicus ...	October	16
Macropisthodon plumbicolor ...	October	14
Coluber helena ...	September	9
Zamenis fasciolatus ...	November	8
Naia tripudians ...	November	7
Typhlops braminus ...	June	6
Echis carinata ...	October	5
Eryx conicus ...	May and January	4 each
Coronella brachyura ...	November	4

During the above-mentioned two years' period, the monthly distribution was the following:—

October—78; September—70; November—59; June—50; July—35; August—25; March—25; May—22; January—22; December—21; February—18; April—9.

Typhlops braminus, the Common Blind Snake appeared on the surface after heavy rains. The largest measured 18 cm. body, its tail was mutilated. The smallest 6·3 cm. body, 0·2 cm. tail; this was captured in the middle of September. Small beetles were found in the stomach.

Typhlops acutus, one was rescued by day from the beak of a cock; another was captured after dusk while crossing a road. The largest measured 35·2 cm. body, 0·4 cm. tail; the smallest 23 cm. body, 0·2 cm. tail.

Eryx jaculus, the Black Earth-Boa, a decidedly uncommon snake along the Railway. The largest measured 89 cm. body, 10 cm. tail; the smallest 35 cm. body, 4·8 cm. tail; this was found end of September.

Eryx conicus, the Red Earth-Boa, was captured by day in most instances. Sometimes in quarters, sheds and latrines. The largest measured 72 cm. body, 4 cm. tail; the smallest 24·7 cm. body, 1·8 cm. tail; this was brought in the third week of July. Rats were found several times in the stomach. A specimen measuring 51·5 cm. body, 4 cm. tail was captured in the compound of the Roman Catholic Church at Kurduwadi in the act of crushing a full-grown striped squirrel. Gastric and intestinal nematodes and cysticerci were found in several instances.

Lycodon aulicus, the Common Wolf Snake, was chiefly found in quarters and after dusk. The largest measured 64 cm. body, 11·6 cm. tail; the smallest 25 cm. body, 4·3 cm. tail. Pregnant females were received in March, April and May. Lizards (*Hemidactylus leschenaulti*, *Calotes versicolor*, *Mabuia carinata*) and small rodents were the common findings in the stomach. Adult parasitic helminths were sometimes seen, but stomach walls and mesentary studded by cysticerci and nematodeora were almost constantly observed in full-grown specimens.

Coronella brachyura, this unobtrusive but handsome little snake was found by day; the first specimen observed climbing on the wall of the dispensary. The largest measured 49 cm. body, 2·3 cm. tail; the smallest found beginning of November; 21·4 cm. body, 3·1 cm. tail.

Oligodon arnensis, the Banded Kukri Snake, largest specimen 52 cm. body, 7·8 cm. tail; smallest 29·5 cm. body, 6 cm. tail.

Oligodon tæniolatus, the Variegated Kukri Snake. Largest specimen 42·2 cm. body, 6·7 cm. tail; smallest 41 cm. body, 6 cm. tail.

Ptyas mucosus, the Common Rat-Snake, was found by day. The two largest specimens measured 165 cm. body, 51·5 cm. tail and 163 cm. body, 66 cm. tail. The smallest received in the beginning of November 57 cm. body, 21 cm. tail. An egg-bound female was found in May. A few specimens were infested by ticks and gastric nematodes. The dhaman does not seem to be a very common snake along the Railway, nor does it attain the large size often observed by the author in the United Provinces.

Zamenis fasciolatus, the Fasciolated Rat-Snake, was constantly found by day and often in open places. In one instance a large specimen was captured in a poultry-yard. The largest and smallest individuals measured 97 cm. body, 24 cm. tail and 29·3 cm. body, 3·5 cm. tail respectively. The latter was brought end of August. Rats were commonly found in the stomach. Gastric nematodes and intestinal cestodes were observed in a few cases.

Coluber helena, the Trinket Snake, was chiefly encountered by day and near dwelling-places. The largest and smallest specimens seen measured 114 cm. body, 25 cm. tail and 30·5 cm. body, 6·2 cm. tail respectively. The latter found end of November. Egg-bound females were brought in July; one contained eleven full sized eggs. Rats, mice and other small rodents were found in the stomach. Helminthic infestation was not observed in any case.

Macropisthodon plumbicolor, the Green Keelback, was captured both by day and by night in grass and while crossing roads. The largest measured 79·5 cm. body, 9·5 cm. tail; the smallest 15·5 cm. body, 2·8 cm. tail (found in the third week of October). Pregnant females were seen in March, April and May. Frogs and toads (*Bufo* *melanostictus*) were found in the stomach. Acanthocephala were observed in a few specimens, but the majority were free from helminthic infestations.

Dipsadomorphus trigonatus, the Common Indian Catsnake, was found both by day and by night, commonly in gardens and around quarters. The largest specimen measured 91 cm. body, 16·5 cm. tail; the smallest 41·5 cm. body, 10 cm. tail. Pregnant females were encountered in May, June and July; one of them containing 14 full sized eggs. In the stomach the commonest contents were small birds, chickens and eggs. Infestations with gastric nematodes and intestinal cestodes were often seen.

Callophis trimaculatas, the Slender Coral Snake. This graceful animal was found by day in the three instances and when captured was seen playing its trick of raising the tail and hiding its head. It never attempted to bite. The largest specimen measured 3·33 cm. body, 2·6 cm. tail; the smallest 20·2 cm. body, 1·9 cm. tail.

Bungarus cæruleus, the Common Krait appeared to be fairly uncommon, only eight specimens being received. The largest measured 87·5 cm. body, 12·4 cm. tail. The smallest 54·5 cm. body, 9·4 cm. tail.

Naia tripudians, the largest Cobra, a male, measured 149 cm. body, 28·3 cm. tail; the smallest, killed end of August, 27·5 cm. body, 5·3 cm. tail. In the stomach were found toads and small birds and in one case another snake—a cobra measuring 44·8 cm. body, 8·8 cm. tail, having swallowed a *Lycodon aulicus* measuring 45·5 cm. body, 9 cm. tail. A few specimens had gastric nematodes and acanthocephali. Old individuals were generally infested with ticks.

Vipera russelli, the Russell's Viper, is the rarest snake in our series, as only one specimen was brought. This was killed by a farmer in a cow-shed near a village about 2 miles from Chink Hill station. It measured 133 cm. body, 24 cm. tail.

Echis carinata, the Saw-scaled Viper, was found by day and in most cases brought alive to the dispensary. The largest measured 40 cm. body, 3·8 cm. tail; the smallest, received beginning of November, 19 cm. body, 1·6 cm. tail. On opening the stomach centipedes were found several times and once a lizard, a *Hemidactylus*. Some individuals were infested by a few nematodes and cestodes.

During the period under review three cases of snake-bite inflicted by poisonous snakes were brought to our notice, and only one of them came to treatment.

At Pangri, a gangman was bitten on his right heel on June 6 at 8 p.m. by a snake described as being darkish and about 1½ foot long. The wound kept on bleeding continuously until 12 noon the following day when it was incised and potassium permanganate rubbed into it. The whole right lower limb was then found marked by swollen purpuric patches, and blisters containing hæmorrhagic serum developed later on the right foot. There were several vomitings and diarrhoeic stools, but as these occurred after taking of a native remedy by the gangman soon after the bite, it is not possible to say whether they were due to the remedy or to the snake venom. The patient recovered but it took over two months for the œdema to disappear entirely. It is likely that this was a case of bite inflicted by the Saw-scaled Viper (*Echis carinata*).

At 3 o'clock in the morning of August 8, a sweeper woman at Barsi town sleeping on the floor suddenly woke up saying to her husband that she had been bitten by a rat. After five minutes she had the sensation of needles and pins over her whole body and she experienced a great thirst. Her speech soon became stammering and after 4 a.m. she could not utter a word. Frothy saliva came out from her mouth. She was dead at 6 a.m. There were two punctured wounds below her right knee. No snake was seen. This is likely to have been a case of cobra bite.

An oil engine driver at Jath Road station was bitten at about 10 p.m. on July 23 on the middle of his back while sleeping on the floor of his quarters. He went for treatment to the temple of the village ½ mile distant and was given a decoction of *nim* leaves which he vomited. He then felt better and returned to his quarters at 11 p.m. Shortly afterwards he said that his ' lungs were getting dry ' and he had difficulty to speak. He was then again taken to the temple where he was seen by the Station Master at about 10 a.m. the following morning. He could then neither speak nor move his limbs according to the report of the Station Master. He expired at about 2 p.m. the same day. The snake in this case was killed and sent to Kurduvadi for identification. It was a *Bungarus cæruleus* measuring 74·5 cm. body and 12·2 cm. tail.

KURDUVADI, K. LINDBERG.
BARSI LIGHT RY.,
November 1931.

XXIV. DESCRIPTION OF A NEW *LYCÆNID* BUTTERFLY.

Lycaena (Formerly **Heodes**) **irmae** Sp. nov.

7 Specimens. Gyantse Tibet 13,000 feet. June.

♂ *Above.* Purple-brown.

F.W. A spot in the cell.

An elongated spot marking the disco-cellulars. Beyond this on the disc, three dark spots in a straight line. Below this line and set at an angle to it, two faint spots in interspaces 2 and 3.

A terminal dark band having a yellow centre at the tornal end. This yellow streak gets fainter towards the apex and disappears in interspace 3.

H. W. A dark line in the cell.

At the tornal angle, a very thin terminal line followed by a black spot in each interspace, followed internally by a dark line of lunules inside of which the purple gloss on the wing is slightly brighter almost forming a purple sub-terminal line. All these markings become fainter towards the apex.

Below.

F.W. Dull yellow.

The marks in the cell and on the disc more pronounced. Those in the cell surrounded with white. The discal marks inwardly margined with white.

A smoky black sub-marginal line with a few whitish scales down the centre at its apical end. Next, a broad band of the ground colour of the wing, getting fainter towards the apex. A subterminal line of elongated spots one in each interspace those in 2 and 3 the most pronounced.

H.W. Yellowish grey with the following black markings inwardly bordered with white. A line of 3 in a straight line at the base of the wing, the centre one being in the cell. Another in the cell with one below it in interspace 2. The disco-cellulars marked as above but much more distinctly, continued at both ends as an irregular line pointing towards the tornus. Below this a bowed line pointing towards the tornus. An irregular line of four dots on the disc. A discal line of white lunules bordered with dusky. A broad terminal yellowish band outwardly margined pale with a terminal dark line. In this band are dark spots getting fainter towards the apex, those in interspaces 1 and 3 are the most pronounced.

♀ As the male but the forewing has a distinct coppery tinge and the purple on both wings is more pronounced.

The spots on the disc are also more defined than on the male and form a curved line inwardly margined with purple. Outside is a yellow line from the costa half way across the wing.

On the hind-wing there are a few faint dark markings inwardly bordered with purple. The tornal markings are more distinct than in the male and there is a line of purple lunules inside of the marginal markings. Underside as in the male but forewing and the tornal markings on the hindwing are more yellow. Cilia of all wings fringed with white. Antennae ringed black and white; expanse 29 mm. to 34 mm. Types of ♂ and ♀ in the British Museum.

The nearest ally to this distinct species is *Heodes li* from which it differs markedly in having no tail.

I have taken *Heodes li* on the Chinese Tibetan border at an altitude of 11,000 feet about 600 miles east of the locality where the present species was found.

Flies among low bushes on the open hillsides in the dry country round by Gyantse, Tibet.

SATNA, C. INDIA, F. M. BAILEY,
October 1931. *Lt.-Col.*

XXV.—DISTINCTIVE CHARACTERS OF THE BUTTERFLIES (*APPIAS LIBYTHEA LIBYTHEA* F. ♂) AND (*APPIAS ALBINA DARADA*, Fd. ♂.)

(*With a diagram.*)

I venture to put forward this note on these two butterflies in the hope that it may be of use to others who, like myself, may find it as difficult as I did, to be sure of distinguishing between them.

Hannyngton, in his list of Coorg butterflies, says that *A. libythea* intermingles with the other *Appiases* on the western slopes. This statement led me to search diligently among the swarms of *A. albina* ♂♂ which haunt the streams and woods. I had Evans' descriptions of the two and consulted Bingham over and over again;

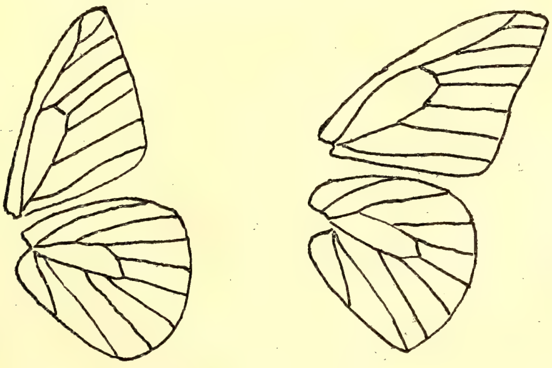
often I thought I had *A. libythea* ♂, and indeed frequently so labelled my slips, but I was always rather doubtful, because at no time did I see the very distinct ♀. On the other hand, in the Bangalore jungles where *A. libythea* undoubtedly occurs alongside *A. albina*, I took ♂♂ of the former which I wrongly labelled *A. albina*, again doubting, because I took them on the same shrubs as I took *A. libythea* ♀♀.

Having now set and examined my catches and having seen the collection of Col. Winckworth and that in the Natural History Museum at South Kensington, I see where my trouble arose, and have noted a few definite characteristics of each, so that I feel sure I should not again be in the quandary I was.

The only illustration I had of *A. libythea* ♂ was that given in Antram's *Butterflies of India* : it is evidently not the S. Indian race that he represents. I turned to Bingham who says '♂ upperside pure white, forewing, costa, apex and termen anteriorly very narrowly shaded with dusky black scales, the black colour produced very freely along the veins for a short distance ' (W.S.F.). Again, D.S.F. ♂ ' Similar but narrow black markings on the forewing still more restricted.' Evans has—'♂ upf veins only dark at margin and not inwardly edged by a dark band '.

I turned up '*A. albina* ', Evans has ' Apex F pointed and termen straight. ♂ upf blackish scaling at apex and base very narrow or absent.' Bingham says much the same with a little more detail. The black scaling is continuous along the termen and not confined to the ends of the veins and inwardly along them.

I suppose a beginner does not go into the more minute differences, such as the colouring of the head, thorax, abdomen; and antennae; and in any case the differences are very slight, and variation seems to be considerable. For myself I was troubled by *A. libythea* ♂♂, taken in the dry season, on which the black scaling was indistinguishable from that of many intermediate types of *A. albina* ♂. (These are represented in the collection at the Natural History Museum, South Kensington). On the other hand a good many *A. albina* ♂♂ (of the W. S. type) seemed very similar to the undoubted W.S.F. of *A. libythea* ♂.



a. Appias libythea ♂ *b. Appias albina* ♂

Mr. R. Winckworth very kindly pointed out to me the first two of the following four obvious differences, which are constant, and have made it possible to distinguish with certainty the one ♂ from the other.

1. *A. albina* ♂: Upf: at the base the white scales have a definitely and obviously pearly tint, which extends more or less over half the wing. In *A. libythea* ♂ the white is uniformly matt.

2. As will be seen by a comparison of the diagrams of the wings of the two butterflies (on page 699), there is considerable difference in the venation, most obviously in the cell of *hw*. Note particularly the difference in the way that *vv* 3, 4, 5 and 6 radiate from the cell in each, and the difference in shape of the two cells.

3. The apex of *fw* of *A. albina* is more pointed and produced than that of *A. libythea*. Consequently the angle made by the termen with the costa is in the former more acute than in the latter. (In most ♂♂ of *A. albina*, the termen, owing to a slight indentation at v. 4, from v 5 to v 6, has the appearance of being slightly falcate. This does not happen in *A. libythea* ♂♂).

Again the tornus of *A. albina* ♂, both of *fw* and *hw*, but more pronouncedly of *hw*, is sharper, more angular, than that of *A. libythea* ♂, which is clearly more rounded.

4. Antennae. (The difference here noted is best seen through a magnifying glass.)

A. libythea. About one-third of the club above is rather brightly ochraceous. The underside of the club is ochraceous. The annulation or speckling, brown and pale ochraceous, is much less distinct than in *A. albina.* The general effect is brown, lighter than in the latter.

A. albina. Only the tip of the club is light ochraceous; the rest is black above, as also beneath, except for three or four white spots. The annulation of the stem is distinct, black and white, and the general effect is much darker than in *A. libythea.*

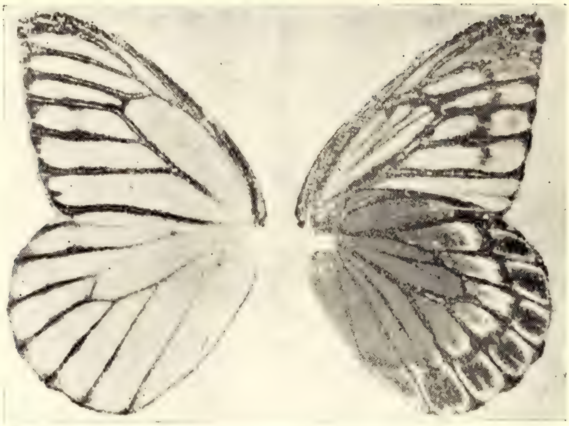
BERKHAMSTED, J. A. YATES.
April 18, 1931.

XXVI.—DRY AND WET SEASON FORMS OF THE BUTTERFLY (*PRIONERIS SITA*).

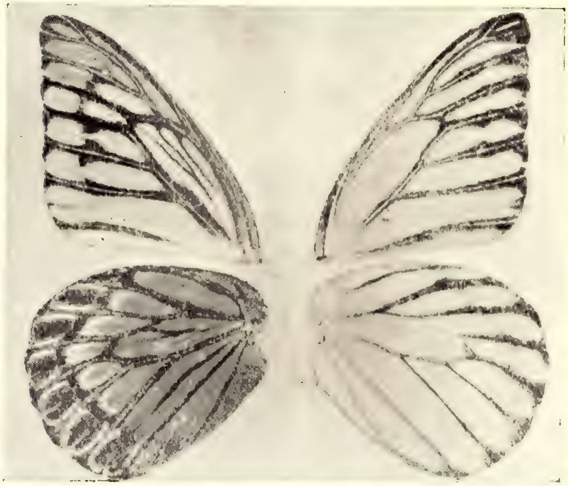
(*With a plate.*)

I have been reading Bingham's description of this butterfly, and conclude that he must have made it from dry season forms; at any rate his description of the ♂ appears to be that of a dry-season ♂.

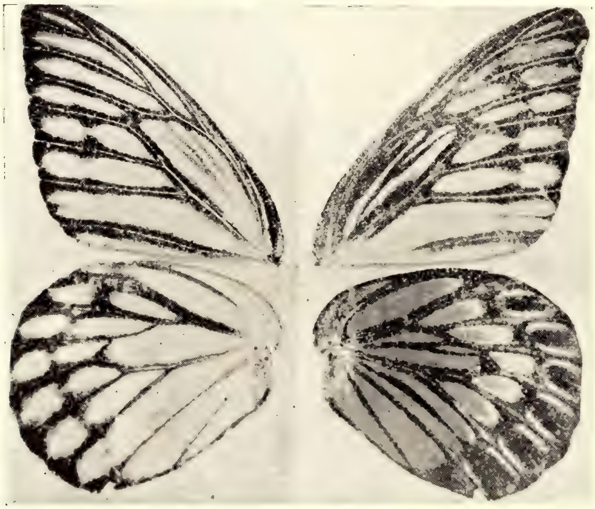
But this insect, which occurs almost abundantly in S. Coorg at certain times (e.g. March–May and September–October) and, so far as my experience goes, is obtainable for ten months of the year, goes through phases from extreme dry to extreme wet colouration; very much in the manner that *Pathysa antiphates naira* does at the same time. Thus the pale D.S.F. both of *Prioneris sita* and of *Pathysa antiphates naira*, occurs in December, and the dark W.S.F. in both cases comes in March–April, and between the two there are transitional broods.



Dry Season Form.
♂ December 1928.



Intermediate Form.
♂ 31st Dec. 1928.



Wet Season Form.
♂ March 1928.

Dry and Wet Season Forms of *Prioneris sita*.

Bingham says '♂ *Upperside* . . . the postdiscal markings of the underside seen through faintly by transparency,' these markings include a 'postdiscal black band' on the hindwing. But in the W.S.F. there is on the upperside also an almost continuous similar black band, that divides the white of the interspaces 1 to 5 ; and the black bands along the veins are much wider, so that the white between them is further reduced ; and along the outer third of the veins the black thickens into triangular markings, and the white between the postdiscal band and the margin becomes a series of roughly heart-shaped blobs. On the forewing also the black bands along the veins are much wider in the W.S.F. than in the D.S.F., with a resulting diminution of the white areas in the interspaces. And on the underside the black borders of the veins are correspondingly thickened ; as also are the 'longitudinal black lines' which traverse the cell on the f.w. (3) and on the h.w. (2). Bingham notes as a distinguishing mark of the ♀ that the cell of the forewing (upperside) is 'traversed by three slender longitudinal lines'—which are strongly marked below in both ♂ and ♀. In the very dark W.S.F. ♂♂, these lines occur above (not by transparency from below) but not so strongly scaled as in the ♀.

The difference between D.S.F. and W.S.F. will be clear if the two photographs on the accompanying plate are compared.

Apart from the fact that the black markings on the wings of the ♀ are generally broader than those on the wings of the ♂ ('on the upperside the veins of the hindwing as well as of the fore being black right up to the base' (Bingham), the apex of the f.w. of the ♀ is rounder and less produced and the termen is slightly falcate at v 4.

BERKHAMSTED, J. A. YATES.
July 7, 1931.

XXVII.—HOW ABUNDANT ARE LAND LEECHES ?

After spending within three weeks of an entire year in India in investigations on the life-histories and behaviour of the true land leeches (*Hæmadipsinæ*), I am forced to the conclusion that they are less abundant than is generally believed. This is certainly true for the times and places of my studies. In preparing the account of these animals for the *Fauna of British India*, I read all available published statements, corresponded with many naturalists and others, and talked with returned visitors from India. From these various sources I had constructed a picture in which land leeches were figured as inhabiting infested areas in something like the order of one to the square inch. Such a picture seems justified by expressions like 'incredible profusion', 'on every grass blade and leaf' and many similar used by the describers. On arriving in India I found that my idea of the abundance of leeches was about the same, so far as favoured areas were concerned, as that held by experienced residents.

At first I was too busily occupied with other observations on these interesting animals to pay much attention to their mere numbers but as figures accumulated, it became apparent: first, that their abundance nowhere approached what had been anticipated, and second, that my first impression of numbers on any spot invariably exceeded the actual number counted. I then began to search for densely populated spots and visited all so reputed, within reach, of which I could learn, only to suffer repeated disappointment. Nowhere were they as abundant as I had been led to expect.

Incidentally to the investigation there accumulated some hundreds of counts of the number of leeches actually taken or seen on a measured square foot or yard or multiple thereof, precautions being taken to standardize these counts and make them as accurate as possible. The most thorough work was done on the four species inhabiting the eastern Himalayas and extended throughout the Darjeeling District and southern Sikkim from early September to the middle of November 1930 and early April to the 1st of August 1931. Some of these figures for the common grass leech (*H. z. montivindicis*) are as follows: On small plots of ground selected for their density of population, the two most populous square feet yielded 20 and 18, followed by others on which were 14, 13, 12 and 9. The total number of land leeches counted on 67 square feet selected for maximum numbers was 376, an average of 5·5 per foot. On another grazing ground where leeches were considered to be troublesome 120 square feet, about equally divided between those selected for numbers and those taken at random, yielded 213 or an average of 1·8 per square foot. Many other similar counts were made and it must be remembered that these were on what are considered to be heavily infested areas, to which such descriptive terms as those quoted above have been applied. Similar results were had on a smaller scale with other species.

Evidently the superlative language used in describing the abundance of these leeches does not apply to my experience. I am puzzled to know just where the discrepancy lies. Have I read into the language of others a meaning not intended by the authors? Or are the impressionistic estimates of the abundance of these animals grossly exaggerated by reason of their unusual and conspicuous appearance, great activity and avidity, and the repugnance commonly felt towards them? Or was I so unfortunate as to have made my studies during a season of minimum abundance? I am very desirous of learning from those who have had much wider experience whether any marked annual fluctuation in numbers has been observed, with what conditions the wax and wane are correlated and whether the season of 1930 would be placed on a maximum or minimum scale. Can any readers furnish figures based on actual counts or really careful estimates of their numbers? How do my figures agree with the experience of others?

University of Pennsylvania, U. S. A. J. PERCY MOORE.

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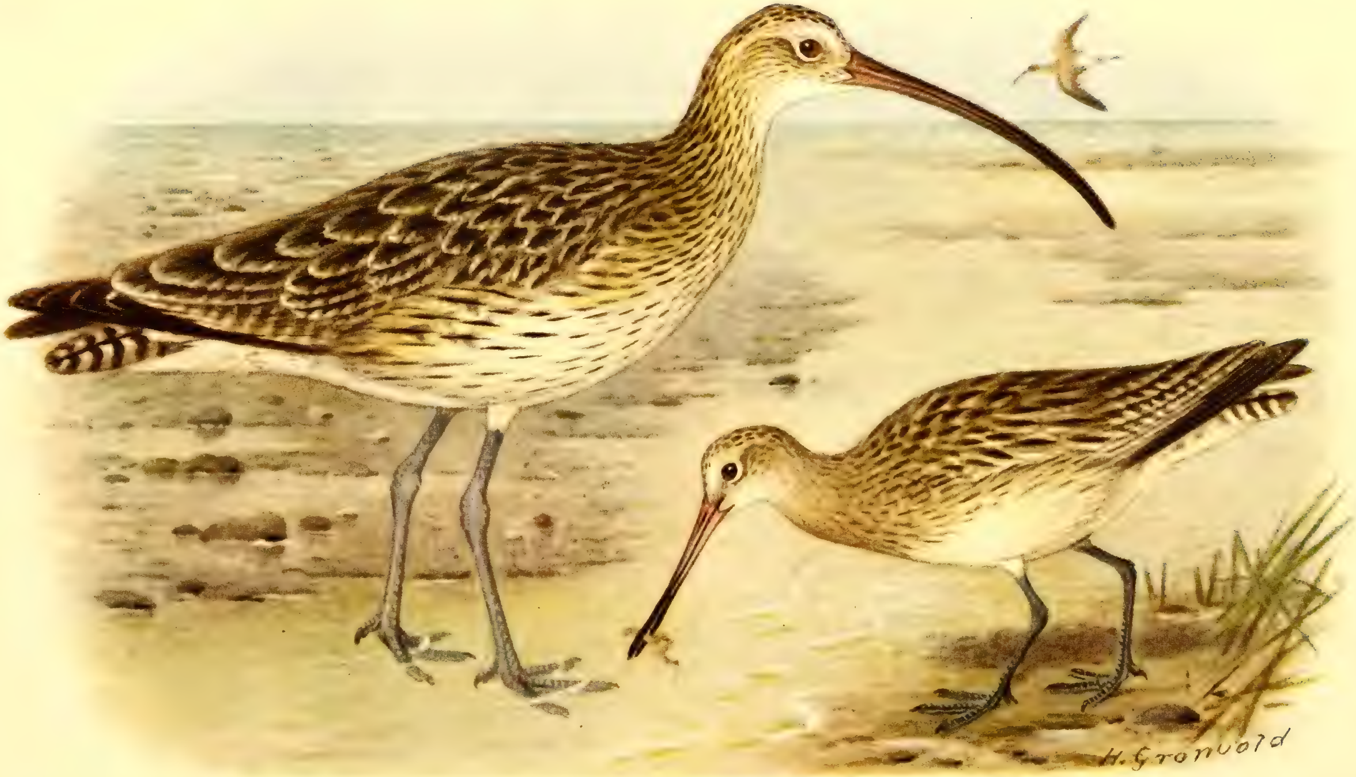

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The Curlew 1/4
Numenius arquata arquata.

The Bar-tailed Godwit 1/4
Limosa lapponica lapponica.

JOURNAL
OF THE
Bombay Natural History Society.

JULY, 1932. VOL. XXXV. NO. 4.

THE GAME BIRDS OF THE INDIAN EMPIRE.

BY

E. C. STUART BAKER, C.I.E., F.Z.S., F.L.S., M.B.O.U., H.F.A.O.U.

VOL. V.

THE WADERS AND OTHER SEMI-SPORTING BIRDS.

PART XVII.

(*With a coloured plate.*)

(*Continued from page 483 of this volume.*)

FAMILY: SCOLOPACIDÆ.

In this family, Lowe includes all those genera which, in the first edition of the *Avifauna*, were embraced in the two sub-families *Totaninæ* and *Scolopacinæ*, with the exception of the one genus *Rostratula*, which I have removed from the latter sub-family and elevated to a sub-order by itself.

In this family the diagnostic characters are the scutellated tarsus and nasal groove which extends over more than half the length of the upper mandible.

The family is divided further into four sub-families, *Tringinæ*, *Eroliinæ*, *Phalaropinæ* and *Scolopacinæ*.

The last of these four families embraces the Snipes and Woodcock, birds which have already been included in vol. ii of *Game Birds*. In the other three sub-families we find those numerous Waders, small and big, of which such vast numbers visit India and Burma during the Winter. Many of these might well be included among our Game Birds, for they are hard to approach, difficult to shoot and good to eat; others may have no pretensions to be classed as Game Birds, yet are of sufficient interest to deserve a brief notice, sufficient to enable sportsmen to identify them if and when shot.

Key to Sub-families.

A. Eyes and ear-orifices placed normally.
  a. Toes with no fringe of lobed web:
    (i) Toes partially webbed at the base ... ... *Tringinæ.*
    (ii) Toes divided to the base ... *Eroliinæ.*
  b. Toes with a fringe of lobed web. *Phalaropinæ.*

AUG 30 1932

B. Eyes placed very far back in the head, with the ear-orifice just below the hinder edge of the orbit ... ... *Scolopacinæ.*

Sub-family: Tringinæ.

The different genera in this sub-family agree in having a slender, and often rather lengthened bill, well provided with nerves. Except in *Numenius*, in which the back of the tarsus is reticulated, the tarsus is scutellated or transversely shielded both in front and behind. There is a distinct Summer and Winter plumage and the sexes are nearly always alike, except in the one genus *Philomachus*.

Key to Genera.

A. Bill long and curving downwards ... *Numenius.*
B. Bill straight or curving slightly upwards.
  a. Bill longer than tail:
    (i) Bill not broader at the end ... *Limosa.*
    (ii) Bill broader at the end and pitted ... *Limnodromus.*
  b. Bill not longer than tail:
    (i) Bill nearly twice as long as tarsus ... *Terekia.*
    (ii) Bill shorter than tarsus or not much longer
    (iii) Sexes alike:
      a. Bill straight ... ... *Tringa.*
      b. Bill curved upwards ... *Glottis.*
    (iv) Sexes not alike in breeding season. *Philomachus.*

Genus: Numenius.

Numenius Brisson, ornith., i, p. 48, v, p. 311 (1760).

Type by taut *Numenius numenius* Brisson = *Scolopax arquata* Linn.

In this genus the bill is very long, slender and curved downwards over the greater part of its length; the tip of the upper mandible is blunt and projects beyond the lower mandible; the nasal orifice is linear and is placed in a groove which extends over about three-quarters the length of the bill; the legs are rather long; the tarsus reticulated except on the lower half in front, where it is covered with transverse scutellæ; the hind toe is moderate in size, the claws dilated and the toes webbed at the base; the wing is long and pointed, the first primary longest and the inner secondaries very long: sexes alike.

This genus contains the Whimbrels and Curlews, which are spread over the greater part of the world.

Key to Species.

A. Crown streaked; wing over 260 mm. ... *N. arquata.*
B. Crown brown with a pale median band; wing under 260 mm. ... ... *N. phæopus.*

NUMENIUS ARQUATA.

Key to Subspecies.

A. Lower parts broadly streaked; axillaries white with bold streaks of blackish.	*N. a. arquata.*
B. Lower parts finely streaked; axillaries pure white or finely streaked with blackish	*N. a. orientalis.*

NUMENIUS ARQUATA ARQUATA.

The Curlew.

Scolopax arquatas.—Linn., Syst. Nat., 10th ed., i, p. 145 (1758) (Sweden).

Numenius arquata.—Blanf. and Oates, iv. p. 252 (part). Fauna, B.I., Birds, Stuart Baker, vi, p. 200, 1919.

Vernacular Names.—*Goar*, *Goungh*, *Barra Gulinda* (Hind.)

Description.—Upper plumage blackish-brown, the feathers of the head and neck with broad fulvous edges, paler and almost white on the sides of the head; mantle with the pale edges browner and assuming the shape of interrupted bars on the scapulars and inner secondaries: wing-coverts with whitish edges which also become similar bars on the greater coverts; a patch of feathers above and below the eye white; lower back and rump white, the centres of the feathers with broad streaks and sometimes bars of blackish; these vary greatly; in many the sides of the rump are pure white, the black showing only as a few black streaks, at the other extreme there are birds with the whole of these parts closely barred and streaked with blackish; upper tail-coverts and tail barred blackish and pale brown, the former more black and white; primaries black with white shafts and the inner webs barred with white, these bars extending on the inner primaries to the outer webs also; chin white; throat white with tiny black striæ, gradually enlarging towards the fore-neck; neck and breast fulvous with broad black central streaks; flanks white with central streaks and cross-bars of brown; abdomen, vent and under tail-coverts white with narrow dark brown centres, always less on the middle of the abdomen and vent and sometimes absent; under tail-coverts with broader dark centres; axillaries white with narrow black bars.

Colours of soft parts.—Iris brown; bill dark brown, the basal half fleshy-brown colour; legs and feet pale-grey, fleshy-grey or bluish-grey.

Measurements.—Wing, ♂ 280 to 303 mm, ♀ 295 to 321 mm.; tail 106 to 121 mm.; tarsus 66 to 80 mm.; culmen ♂ 100 to 124 mm., ♀ 130 to 152 mm. (*Witherby.*)

Young birds have the feathers of the upper parts edged with buff and the upper tail-coverts and rump suffused with buff, whilst the streaks on the breast and abdomen are narrower.

Nestling.—Above creamy-buff, the sides of neck and fore-neck darker rufous-buff and the under surface buffy-white; a broad central streak of brown from forehead to nape; posterior crown freckled black and buff; an eye-streak dark brown; a dark brown patch on the hind-neck; two lateral bands of dark brown down the back; two patches of brown on the wings and two short blackish lines below the dorsal lines.

Distribution.—Northern and Central Europe, South to Dobrugea etc. In Winter, South to Africa, Madagascar and North-West India as far East as Delhi and as far South as Ceylon.

Nidification.—The Curlew breeds in Northern Europe from the end of April to the end of May and in its more northern limits as late as June, but I found eggs laid in the south of Lapland and in Northern Finland in the third week of May when there was still snow in drifts everywhere. They select a site anywhere in marshy land, whether this is almost on the level of the seashore or on the boggy crests of high hills. In England they are getting much more common than they were and in Eastern Wales and the adjoining counties they have even been known to breed in wheatfields and similar situations. Normally, however, their home is in the wilder countries and there is no bird whose nest is harder to find. The nest itself is a hollow in amongst grass or weeds either scratched out by the birds or a natural one, and this is almost invariably well lined with weeds, grass or soft reeds. Occasionally a nest may be found on dry sand hills some distance from any wet spot but as a rule this is only when the birds have been harried and driven from other more favourite wet grounds. When not sitting himself, sometimes the male bird keeps watch near the nest and gives the alarm to his mate on the approach of danger but, even when he does not do this, the sitting hen is so extraordinarily alert that it is very difficult to approach within two or three hundred yards of the nest before she leaves. When she does so she generally slinks quietly along for some distance before rising, so as not to give away the position of her eggs or young. If however one happens to come upon the sitting hen suddenly, she lies very close and I have occasionally been able to watch a bird from a distance of only a few yards for some time before she has eventually made up her mind to clear out. The eggs are of course always four in number and are very large for the size of the bird. In shape they are long pyriforms and the ground colour varies from a pale grey green to a rather dark olive-grey or olive-brown, occasionally almost bright olive-green. In most eggs the markings consist of small spots and blotches freely scattered over the whole surface of the egg but nowhere very bold or well-defined. A few eggs however have large handsome markings which are most numerous at the larger end and spare elsewhere, whilst a few others have the blotches intermixed with small twisted lines and scriggles. One hundred eggs average 67·2 × 47·4 mm.; maxima *75·5* × 55·0 mm.; minima 56·2 × *44·0* mm. and 61·0 × *43·0* mm.

Habits.—The Common Curlew is a numerous visitor to North-West India from whence it straggles down South as far as Ceylon and East as far as the United Provinces. There have also been a certain number on record from considerably further east, as from Bengal and Assam, but I have seen no specimens thence and such records are probably all referable to the next race of Curlew. Even in Sind and the Punjab many references to the Curlew must really be to the eastern form, for Ticehurst says ' Sind and Punjab birds are typical *lineatus* (= *orientalis*) with almost unspotted underwing and rump and pure white axillaries ' (Ibis 1924, p. 130). With us in India the Curlew is a shy bird but not always unapproachable and a fair number are shot, especially when they are feeding with other waders, but in its summer home and when breeding it is one of the wildest birds imaginable and, long before one can get within distance even for observation, it rises with its loud screaming note and disappears. Its ordinary call is the well-known haunting cry from which it takes its name, a wild but very sweet ' Cur-lew, cur-lew.' In addition to this, it has a musical note sounding rather like ' What-what.' The Curlew is one of the birds which seem to feed all night. Sometimes, when in Finland and Lapland, I have been watching Nature by the midnight sun between the hours of 11-0 p.m. and 2-0 a.m.; a curious hush seems to come over everything as if even the birds considered it time to rest in spite of the bright daylight. Every now and then, however, this weird stillness would be broken by the wail of the Curlew as it flew overhead from one feeding place to another and, undoubtedly these birds continue to feed all through the night. They eat almost any small living thing : insects, reptiles, coleoptera, slugs, worms and grass-hoppers. They also at times eat seeds, berries and shoots of various plants and seaweed. Its flight is very powerful and swift and our Winter visitors are certainly worthy of the status of game birds, for they are hard to get near to shoot, difficult to bring down and excellent eating when shot.

NUMENIUS ARQUATA ORIENTALIS.

The Eastern Curlew.

Numenius orientalis.—Brehm., Handb. Vogl. Deutsch., p. 610, (1831) (East Indies).

Numenius arquatus.—Blanf. and Oates, iv, p. 252, (part)

Numenius arquata lineatus.—Stuart Baker. Fauna, B.I., Birds, vi, p. 202, 1929.

Vernacular Names.—*Goar*, *Goungh*, *Barra Gulinda* (Hind.) *Choppa*, *Sada Kastachura* (Beng.) ; *Borinda* (Sind).

Description.—Differs from the preceding bird in being lighter, more fulvous, less brown above ; the lower parts are streaked with much finer, paler streaks ; the lower back and rump are often almost unstreaked white and are never barred as in some specimens of *N. a. arquata* ; the axillaries are pure white or very lightly streaked on the longest only.

Colours of soft parts, as in the typical form.

Measurements.—Wing, ♂ 280 to 297 mm. ♀ 300 to 314 mm. ; culmen ♂ 137 to 159 mm. (one Calcutta 167 mm.) ♀ 135 to 194 mm.

Distribution.—From Baikalia to Kirghis Steppes and West Siberia. In Winter south to the whole of India, Burma, China, Philippines, etc. In India it occurs on all the coasts commonly as far south as Ceylon and also inland wherever there are large areas of swamp and lake, extending to the extreme West in Sind and the N.-E. Frontier Provinces and Punjab. It has been recorded also from the Sudan.

Nidification.—Taczanzanowski describes the nests and eggs of the Eastern Curlew as indistinguishable from those of the Western bird, nor do they seem to differ in size. The only eggs in my own collection are some taken by Smirnoff, who took many clutches at Krasnoyarsk and Yenesei, which he attributed to the Common Curlew but which must of course have belonged to the Eastern race. Hartert says that this form of Curlew breeds throughout Dauria in the Eastern Baikal district and West Siberia to Trans-Caspia and the Eastern Kirghiz Steppe, whilst Witherby gives the limits of the Common Curlew as the Russian Kirghiz Steppes. *Numenius cyanopus* breeds much further to the East, whilst the Slender-billed Curlew also breeds in Trans-Baikalia eastward but is a much smaller bird. It therefore seems certain that Smirnoff's eggs generally refer to our present sub-species. According to Smirnoff the clutches, as one would expect, are all of four eggs and were all deposited on the ground on flat marshy land close to the Eastern banks of the Yenesei River, the one set taken at Krasnoyarsk being of course considerably to the West of this. All my eggs are rather dull and uninteresting specimens, one set of four, however, being paler than the others. They can all be exactly duplicated by eggs of the Western Curlew. Sixteen eggs average 65·4 × 47·0 mm., maxima *73·2* × 48·5 and 70·6 × 50·1 mm., minima *62·1* × 44·6 and 63·6 × 41·9 mm. The earliest were taken on the 24th of May and the latest on the 16th of June. Judging by the way in which they are blown, they were all quite fresh but Smirnoff says that he saw young birds at the end of June.

Habits.—In India, the Eastern Curlew may be found in some numbers in the huge river deltas in the north of the Bay of Bengal whence it extends in lessening numbers as far south as Ceylon. It is more of a sea-coast than river bird during the cold weather but it may be found also inland in swamps and sandy banks of the larger rivers, whilst I have twice shot it in Bengal in rice-fields when out snipe-shooting. In Assam, it was not uncommon and, it is interesting to note, that its migration route seemed to be from one range of mountains to another and not along the course of the big rivers such as the Brahmapootra until these debouch into the plains. Thus, when in North Cachar on the higher mountain ranges running up to some 7,000 ft., I frequently heard these birds flying overhead at night, following a direct north-to-south course, indicating that they had come straight across the Brahmapootra from ranges to the north of that river. When they first arrive, the birds are not wild, and I have seen birds so tired that they allowed of approach within some 20 yards. Later on in the season they become much more wild and are then difficult to approach. They occur with us either singly or in very small parties not exceeding half a dozen, and they may be seen feeding either in the swamps or standing idly on sandbanks in the bigger rivers. As regards notes, flight, food, etc., I have been able in no way to distinguish between the Western and Eastern forms of Curlew.

NUMENIUS PHÆOPUS.

Key to Subspecies.

A.	General colour paler; dark bars and streaks less heavy	*N.p. phæopus.*
B.	General colour darker; dark bars and streaks broader and more numerous ...	*N.p. variegatus.*

NUMENIUS PHÆOPUS PHÆOPUS.

The Whimbrel.

Scolopax phæopus.—Linn., Syst., Nat., 10th ed., i, p. 146 (1758) (Sweden).

Numenius p. phæopus.—Blanf. and Oates, iv, p. 253 (part). Stuart Baker, Fauna. B.I., Birds, vi, p. 203, 1929.

Vernacular Names.—Chota goungh, Chota gulinda. (Hind.)

Description.—Head dark brown, the feathers edged with whitish; on either side of the crown the white is obsolete and the dark centres form two dark brown patches, leaving a median pale coronal line and two supercilia pale brown like the forehead; a small brown patch in front of the eye; lores, sides of the head and whole neck brown, each feather with broad whitish edges; upper plumage dark brown with pale brown edges forming bars on the scapulars and inner secondaries; rump and upper tail-coverts white, marked with brown in varying degree as in the Curlew; tail light brown banded with black and the lateral feathers with white tips; lower parts white, the neck, breast, flanks and under tail-coverts streaked with brown, axillaries white with dark brown bars.

Colours of soft parts.—Iris hazel or dark brown; bill dark horny-brown, fleshy-pink at the base of the lower mandible; legs and feet greenish-grey.

Measurements.—Wing, ♂ 232 to 250 mm., ♀ 243 to 265 mm.; tail 87 to 99 mm.; tarsus about 50 to 61 mm.; culmen, ♂ 76 to 86 mm., ♀ 80 to 99.

Young birds have the feathers of the mantle notched and edged with pinkish-buff and the rump suffused with the same; the feathers of the lower back, rump and upper tail-coverts finely edged with brown.

Nestling in down.—Like that of the Curlew but with central streak of buff and two broad lateral streaks of brown on the crown from the forehead to the nape.

Distribution.—Breeding Northern Europe, Iceland, Greenland to Western Siberia. South in Winter to Northern Africa and the eastern coast as far as Madagascar; Arabia and North-West India.

Nidification.—All over the greater part of its breeding range, which extends throughout Northern Europe to Western Siberia, the Whimbrel breeds during the latter half of May and early June and even in its northern haunts, where the snow lies on the ground until the end of June, I have taken eggs hard set on the third of that month and the local Lapps and Finns told me that they had often taken their eggs in snow of some depth. In Northern Lapland they are extraordinarily common and twenty or thirty pairs may be found breeding on a swamp, a couple of miles long by about a mile broad. They are not nearly so shy as Curlew and with a little patience the birds may be easily watched back on to their nests after they have been once disturbed. This is indeed the easiest way to find their nests, for although once found the eggs look very conspicuous, they are very easy to miss. Most of the nests we found in Lapland were mere scratchings in the ground on slightly raised, exposed, comparatively dry ground in the favourite feeding swamps of that country. No nests were made, although in a few cases a certain amount of dry grass and lichen seemed to have been accumulated in the hollows. Most nests were placed in natural hollows in the reindeer moss which, clear green grey and white as it was, agreed extraordinarily well in general tone with the colour of the eggs of the Whimbrel. Occasionally the eggs may be laid in a scratching on bare soil, and in these cases the eggs can generally be seen at a distance of some yards away and are consequently easy to find. The actions of the Whimbrel when returning to its nest are well worth watching. When first disturbed, the bird gets up and flies away to a considerable distance uttering a harsh loud call but, if one sits down quietly close by, within a very few moments the hen bird certainly, perhaps both birds, return, flying round in circles which gradually decrease in size until one or both birds alight within a couple of hundred yards of the nest. From this point they casually approach their eggs, not in a direct line, but in zigzag fashion, feeding as they come and every now and then taking short flights which generally bring them to a point closer to their nest. Finally, having satisfied itself that there is no danger, one of the pair walks quietly on to its nest and after arranging the eggs to its satisfaction, sits down and begins to brood. As a rule the other bird of the pair remains about a hundred yards away, apparently feeding and taking no interest in what is going on but actually keeping a keen lookout on everything around it. A hundred eggs average 58·9 mm. × 41·3 mm.; maxima *65·1* × 43·7 mm. and 57·0 × *44·0* mm.; minima *52·0* × 41·0 mm. and 55·3 × *36·0* mm. The eggs are small editions of those of the Curlew but I have seen a few varieties which are uncommon in those of that bird. One of these types has a ground colour of quite bright green blue, handsomely marked with bold blotchings of black or blood-red, and a second type is a pale greenish yellow with innumerable tiny specks and spots of grey brown and chestnut brown. A third type which is quite common in the Whimbrel's egg, though so rare in that of the Curlew, is one which has the markings all accumulated at the bigger end of the egg, forming either a ring or a cap, whilst the rest of the egg is almost immaculate.

According to the local Lapps, the male Whimbrel does the greater part of the incubation though it is relieved at times by the female. Later, when the young are advanced, the male seems to assume sole charge and it is said that the female Whimbrel migrates south some days in advance of the male, who remains behind to give the last touch of education to their young, whom he then accompanies south. The same is said to be the case with the Curlew and the Godwits.

Habits.—The habits of the Whimbrel are so much like those of the Curlew that it is difficult to add anything to the account of that bird. It is a very common Winter visitor to the North-West and West of India, occurring as far South as Ceylon. It is, like the Curlew, for the most part a coastal bird, though it may be found as well on the larger swamps and rivers. In Sind Ticehurst says that the Whimbrel arrive in the first week in August and from then on to the middle of September, when it is very common on the coast. He says: "Their arrival is looked for by the more ardent sportsmen at Karachi since, as they flight to and from their feeding-grounds in the creeks, they afford capital sport and are, moreover, excellent eating. By early October the main body have departed; I have notes of small lots up to 7th November, and occasionally in Winter. It seems scarcer on Spring passage. I have noted it in the second week of May, but quite a number over-Summer (as Butler also noted), frequenting the mangrove creeks, where I have met with it all through June and July. At high water it may frequently be seen perched up on the top of a mangrove bush, a habit Hume also noted in the Andamans. I have seen it at the fresh-water swamp at Karachi, and it occurs on the inland waters of the province during its passage."

Birds shot in mid-June have commenced their complete moult; migrants newly arrived (adults in August, young in September) had not begun to moult. These Sind birds are more spotted on the lower back and rump than most western European ones, but not so much as in *variegatus.*

The call is very like that of the Curlew but more prolonged and trilling and I think it is a more noisy bird, but this may be merely because where found, it is so very common, and therefore more in evidence. When migrating, Witherby says that its presence is often revealed by its clear, tittering cry of 'Tetty, tetty, tetty, tet.' Its food and flight are similar to those of the Curlew.

NUMENIUS PHÆOPUS VARIEGATUS.

The Eastern Whimbrel.

Tantalus variegatus.—Scop., Del. Flor. et Faun., Insubr., fasc., ii p. 92 (1786) (Luzon).

Numenius phæopus.—Blanf. and Oates, iv, p. 253 (part).

Numenius phæoceps variegatus.—Stuart Baker, Fauna B.I., Birds, vi, p. 204, 1929.

Vernacular Names.—None recorded.

Description. Differs from the preceding bird in being much darker with more brown and less white; the lower back, rump and upper tail-coverts are much more heavily barred with brown and the striations on the lower plumage heavier; the flanks and under tail-coverts are broadly barred with dark brown as well as streaked; axillaries and under wing-coverts white profusely barred with dark brown.

Colours of soft parts as in the Whimbrel.

Measurements.—Wing, ♂ 231 to 239 mm., ♀ 227 to 239 mm.; tail 89 to 100 mm.; tarsus 60 to 64 mm.; culmen, ♂ 77 to 84 mm., ♀ 83 to 90 mm.

Distribution.—Breeding East Siberia, migrating south in Winter to China, the islands from the Celebes to Sumatra, Indo-Chinese countries and Malay States, and casual in Burma. On the east it is found as far as New Guinea, Australia and Tasmania.

Nidification.—There is nothing on record so far as I can ascertain, and the only eggs I have seen were those taken by Smirnoff, one clutch on the Yenesei, and two clutches, each of four eggs, somewhere near Station Echo in Manchuria. In appearance they are indistinguishable from those of the Common Whimbrel, and they were said to have been taken on swampy tundra and lake country in early June.

Habits.—The Eastern Whimbrel is a common Winter visitor to the Indo-Chinese countries and Burma and probably also to Assam and Eastern Bengal, its occurrence having been noted merely as that of the Common Whimbrel. I shot one bird of this race on a small lake in North Cachar in 1899, which had been in the company of two others, and I saw a small flock in Lakhimpur in 1900 which would not allow me within shot, as it was in the company of a particularly wild flock of Golden Plover. In its general habits this bird differs in no way from the Western form. Both Curlew and Whimbrel may be considered really sporting birds, for they have all their attributes, difficulty of approach, speed of flight and the third requisite, excellent flesh for the table.

GENUS : LIMOSA.

Limosa Brisson, Ornith., i, p. 48, v, p. 261 (1760).

Type by taut., *Scolopax limosa* Linn.

In this genus the bill is long and straight; both mandibles are grooved, the linear nostrils being placed near the base of the bill in the upper groove; the tarsus is moderate in length, partly shielded both in front and behind, the hind toe is well developed and there is a web between the outer and middle toes but only a rudiment of one between the middle and inner toe; the middle toe is dilated and sometimes pectinate on the outer side; the wing is long and pointed with the first primary longest, the tail is rather short and almost even.

The genus is cosmopolitan, two species visiting India in the cold weather.

Key to Species.

A.	Base of tail white, terminal half black ...	*L. limosa.*
B.	Tail barred black and white over the whole of the outer rectrices and most of the central ...	*L. lapponica.*

Limosa limosa.

Key to Subspecies.

A. Larger; wing 210 to 240 mm.; culmen 85 to 126 mm. ... *L. l. limosa.*
B. Smaller; wing 176 to 207 mm.; culmen 77 to 87 mm. ... *L. l. melanuroides.*

Limosa limosa limosa.

The Black-tailed Godwit.

Scolopax limosa Linn., Syst. Nat., 10th ed., i, p. 147 (1758) (Sweden).

Limosa belgica—Blanf. and Oates, iv, p. 254 (part).

Limosa limosa limosa.—Stuart Baker, Fauna B.I., Birds, vi, p. 205.

Vernacular names.—*Gudera*, *Gairiya*, *Jangral*, *Khag* (Hind.), *Malgujha* (Nepal); *Jaurali* (Beng.); *Gondu ulanka* (Tel.).

Description.—*Breeding plumage.* A pale rufous supercilium from the bill to the ear-coverts; forehead, crown and nape dark rufous streaked with black; lores rufous speckled with black; chin and throat whitish or pale rufous; neck all round rich rufous; back, scapulars and innermost secondaries blackish, broadly barred with pale rufous and edged with white at the tips of the feathers; lower back brownish-black; upper tail-coverts white with black tips; tail blackish, white at the base, the white narrow on the central tail-feathers, broad on the outer, all the feathers tipped whitish; innermost wing-coverts blackish next the scapulars; median and greater coverts grey-brown, bordered with white, forming a broad wing-bar on the greater coverts; primary coverts brownish-black, tipped with white; primaries dark brown, paler on the inner webs, with a wedge-shaped indistinct white mark on the first primary, becoming white on the succeeding primaries and at the same time restricted in extent and forming a white base to the 4th, 5th and 6th primaries; outermost secondaries blackish with white bases and white tips; intermediate secondaries brown with narrow pale edges; breast rufous, barred with black; abdomen and posterior flanks rufous, heavily barred with black and with white bases and narrow white fringes; under tail-coverts white barred with black; axillaries and under wing-coverts white.

Colours of soft parts.—Iris hazel or dark brown; bill dull orange-red or dusky-orange, more red at the base and dusky at the tip; legs and feet greyish-green.

Measurements.—Wing, ♂ 210 to 226 mm., ♀ 215 to 240 mm.; tail 74 to 89 mm.; tarsus 75 to 82 mm.; culmen, ♂ 88 to 107 mm., ♀ 104 to 126 mm. (Witherby.)

In Winter the upper parts are dark brown or blackish, each feather edged with fulvous; the neck more rufescent, with the dark centres obsolete; chin, throat and face pale fulvous, deepening in colour on the fore-neck and tinged with rufous-grey, thence paling to white on the abdomen and under tail-coverts.

Females are like the male but do not always assume so fully rufous a summer plumage.

Nestling down of upper parts buffy or greyish-white, grizzled more or less with brownish; crown and a line from the upper mandible light brown; a buff supercilium meeting behind the crown; a broken brown dorsal line to the uropygium; under parts greyish-white.

Distribution.—Northern Europe from Iceland, Holland and South Finland, Hungary and Russia to Western Asia probably as far East as Lake Baikal. In Winter South to Africa and North-West India. Common in India in the North-West and thence becoming scarcer towards the South though it has occurred in Ceylon. To the East it has been obtained in the United Provinces and Western Bengal.

Nidification.—The Black-tailed Godwit breeds in Northern Europe and Asia, probably as far East as the Baikal district, although its exact limits are not yet known. In Russia, according to Witherby, it breeds as far North as Lat. 60° but it also breeds South, probably down to about Lat. 45°. It makes its nest in or round about marshes and on the shores of lakes, whilst in Holland it is said also to breed amongst the bushes and scrubby grass of the sandhills. The favourite site, however, is undoubtedly the rank grass of swampy muddy land round marshes and the nest, as a rule, is very well hidden and difficult to find except by the watching of birds on to the nest. The nests are said to be quite well made, pads of grass or blades of rushes placed either in natural hollows, or in amongst the roots of the grass. The eggs are almost invariably four in number and are not unlike the eggs of the Whimbrel but are generally easily recognised for, whereas the eggs of the Whimbrel are nearly always more or less pegtop in shape, the eggs of the Godwits are longer, narrower and less pointed, moreover most are duller and less boldly marked than the eggs of the Whimbrel. The texture is perhaps slightly less smooth and polished. At the same time unusually-shaped eggs of either species may be met with, which are very difficult to assign to one or the other. The ground colour may be anything from a palish olive-ochre, olive-brown or olive-green to a rather dark shade of the same, whilst the markings consist of very numerous small blotches and freckles of dull umber-brown, ochre-brown or grey-brown distributed almost equally over the whole surface and nearly always rather dull and indistinct. Jourdain gives the measurements of 100 eggs as follows. Average, 54·7 × 37·3 mm., maxima *59·8* × 37·8 and 53·3 × *40·7* mm., minima *48·5* × 37·7 mm., and 55·0 × *34·0* mm.

They are early breeders and eggs may be found as early as the middle of April and from then onwards throughout May over most of its breeding area, whilst in Iceland the breeding season may be taken as about a month later. As with the Curlew and Whimbrel, so with the Godwit; both sexes share in incubation and it is probable that the male does the greater part. The period for which they sit is said to be 24 days, whereas that of the Curlew is 30 days and that of the Whimbrel 25 or 26 days. It is recorded also that the male bird is the better parent of the two in feeding and looking after the young.

Habits.—The Godwit arrives in the North of India about the first week in October, leaving again during March and April but in North-West India it is said to arrive sometimes as early as August. In the North-West it may be seen in very large flocks but in the North-East it will be seldom seen in flocks over a dozen, though I once saw a flock in Nadia, Eastern Bengal, in which there must have been fully a hundred birds. Whilst they may be found in any kind of marsh or river, they seem to prefer the margins of swamps or lakes and during the winter they are certainly much less sea-shore birds than are Curlew and Whimbrel. It is just as sporting a bird as is either of the two just mentioned ; as difficult to approach, as hard to shoot when one has got within shooting distance, while it is equally good to eat. One of the biggest bags I ever made in one shot was as a youngster in Bengal when, after considerable time and trouble, I succeeded in getting within a shot of a flock of these birds, my two barrels gave me a net bag of seven Godwit, a great many cows and the cow-keeper, a shot which had to be paid for to the tune of what was to me then a large sum in rupees, though there were no fatalities other than among the Godwit.

The food of the Godwit is much the same as that of the Curlew but Ticehurst found that those he shot in Sind had been feeding entirely on crustaceans and on what was apparently a water beetle.

Before they leave us a great many birds have assumed their summer plumage, either in part or in toto and, more especially in Western India, a few birds linger within our area throughout the summer. Their cry is a musical trisyllabic whistle, sounding like ' Whist, whit, twit,' and it has a low single note, the only one we hear in India, as it rises from the ground and when it again settles.

LIMOSA LIMOSA MELANUROIDES.

The Eastern Black-tailed Godwit.

Limosa melanuroides Gould, Birds of Australia, pt. xxxiv, vol. vi, pl. 38, (Port Essington, Australia).

Limosa limosa melanuroides Stuart Baker, Fauna B.I., vi, p. 207.

Vernacular Names.—None recorded.

Description.—Resembles the preceding race but differs in being rather smaller with a shorter bill. In the breeding plumage the colouring is perhaps a trifle richer, the rufous deeper and the dark bars more black, less brown.

Colours of soft parts as in the typical form.

Measurements.—Wing, ♂ 176 to 197 mm., ♂ 182 to 207 mm., tail 68 to 86 mm. ; tarsus 66 to 73 mm. ; culmen, ♂ 77 to 95 mm., ♀ 78 to 87 mm.

Distribution.—Eastern Siberia to Japan. In Winter, south to Eastern India, Burma, China, the Malay Archipelago and Australia. Exactly where the two races merge into one another is not known but probably somewhere about Lake Baikal. In Burma it is not rare in Winter and it occurs in Calcutta and Eastern Bengal, whilst numbers visit Assam yearly.

Nidification.—At present there is nothing recorded in regard to the nidification of this bird but Smirnoff obtained eggs of a Godwit in

Northern Manchuria which he believes to have been those of the present species. In appearance they are indistinguishable from the eggs of the Bar-tailed Godwit but are even smaller than those of that bird. Two clutches sent to me average only 52·8 × 36·1 mm. As the bird itself is smaller than the Bar-tailed Godwit, the eggs are probably correct. Both these clutches are now in my collection and are of a dull, almost unicolour type. They were said to have been taken in swampy tundra on the 4th and 16th of June.

Habits.—This bird is quite common during the cold weather in Eastern Bengal and Assam, where I have shot numbers for the pot. It occurs as a rule in small flocks, generally half a dozen to 20 or 30 but, just after and just before migrating, it often collects in very large flocks and I have seen some of these numbering as many as 200 and, once, one of probably twice that number. Our first arrivals in Assam generally appeared in early September, but the greater numbers not until well on into October. By April the small flocks began to join up and before the 15th of that month the last had disappeared, with the exception of a few birds, probably non-breeding ones, which might be seen in June and July and which probably did not migrate at all to the northern breeding grounds. In Eastern Bengal it is quite as common as in Assam and it is of course found throughout Burma from the north to the extreme south of Tenasserim. How far South it occurs in India I have been unable to trace. It certainly occurs as far south as the Chilka lake in Orissa but south of that I can find no record. It is quite a sporting bird in its shyness and speed of flight and it is such an excellent bird for the table that it is well worth while stalking. Its diet is probably mainly animal, consisting of all kinds of insects, small mollusca and various small worms which it obtains by probing in the deep mud with its long bill. In Assam, however, several birds which I examined seemed to have been feeding on grass seeds and a tiny black seed of a water plant which was very plentiful in the swamps. The only cry I heard was a very pleasant triple note, sounding like 'Tir-ree-wee' twice repeated as the birds rise and occasionally as they wheel and circle in the air. It is said also to have a single loud harsh call but this I have not heard.

LIMOSA LAPPONICA LAPPONICA.

The Bar-tailed Godwit.

Scolopax lapponica Linn., Syst. Nat., 10th ed., i, p. 147 (1758) (West Europe).

Limosa lapponica.—Blanf. and Oates, iv, p. 256.

Limosa lapponica lapponica Stuart Baker, B.I., Birds, vi, p. 208, 1929.

Vernacular Names.—Same as for *L. l. limosa.*

Description : Breeding plumage.—Crown and lores rufous with black streaks; supercilium, sides of head, whole neck, breast and under plumage rich rufous; feathers behind the eye and a line down the hind-neck streaked with black; mantle and inner secondaries rufous with broad central streaks of black, these dividing the rufous on the inner secondaries into notches; lower back, rump and upper tail-coverts white, more or less streaked with black, the longest coverts suffused with a little rufous; tail barred black and white throughout, the central tail-feathers slightly suffused with rufous; primaries black with white shafts and the 1st to 6th or 7th mottled with white on the base of the inner webs, remaining primaries black with narrow white internal edgings; outer secondaries brown-grey with white edges and a white inner streak following the contour of the feather; axillaries and under wing-coverts white with black streaks.

Colours of soft parts.—Iris brown; bill pinkish flesh-colour, the terminal half horny-brown to almost black; legs and feet greenish-grey to almost black.

Measurements.—Wing, ♂ 202 to 216 mm., ♀ 211 to 227 mm.; tail 66 to 77 mm.; tarsus 46 to 51 mm.; culmen, ♂ 72 to 83 mm., ♀ 95 to 106 mm. (Witherby.)

In Winter the rufous disappears; the upper parts are brown, each feather edged with fulvous; the wing-coverts are broadly edged with pale fulvous; chin and throat albescent; fore-neck and breast fulvous-brown, with a pinky tinge and faintly streaked with darker brown, the streaks more distinct on the flanks; abdomen and under tail-coverts white or fulvous-white; the sides of the head pinkish-fulvous, much streaked with dark brown.

Females are similar to the male but do not always assume so complete a breeding plumage.

Young birds in the first autumn have the upper parts more marked with buff spots, which also form notches on the inner secondaries.

Nestling like that of the previous species but less pink in general tone and with the coronal and other dark marks better defined.

Distribution.—Breeding in Northern Europe from Lapland and North-East Finland to the Yenesei in Asiatic Siberia and probably as far East as the Taimyr Peninsula. In Winter it migrates south to Africa and the Mekran coast, Sind and Cutch in North-West India.

Nidification.—The Bar-tailed Godwit is a very early breeder when one considers the climate in which it nests. Many birds lay as early as the middle of May, when the swamps are still half-frozen and snow still covers the ground in all directions. In Northern Lapland they breed in the same swamps as the Whimbrel and many other waders but whilst the Whimbrel lay their eggs absolutely in the open on caked mud or reindeer moss, etc., the Godwit seems always to select thin grass in which to make its nest and, though once found, the eggs seem very conspicuous, they are to a slight extent concealed by the surrounding grass and would certainly escape the notice of a careless observer. This year, 1931, I have been fortunate enough to be able to visit the Lapland breeding grounds of this Godwit, which was really quite common in some of the swamps. As with all our waders, it seemed to be very capricious in its choice of a breeding site. I remember one day we visited no less than four swamps, each of which to the human eye seemed exactly the same, vast stretches of horrible quaking bog, dotted here and there with little hummocks and small flats of comparatively dry ground. All round them stunted fir and birch grew fairly thickly, whilst the surface of the swamp itself was more or less covered with water weeds, thin struggling grass and, in places, thicker vegetation such as salix and kindred plants. In three of these swamps bird life was conspicuous by its absence and not a single Godwit was to be seen, yet in the fourth, everywhere we went, waders large and small were busy carrying on domestic duties and among them were some four or five pairs of Bar-tailed Godwits, two of whose nests we were fortunate enough to find. Both nests contained four eggs but whilst in one the eggs were absolutely fresh, in the second, the eggs were at least fifteen days incubated. This was on the third of June; a bitter North-East wind was blowing and driving dense masses of falling snow almost horizontally across the landscape. In these out-of-the-way places we did not find the Godwit very wild and the birds would return to their nests within a short time of our putting them up; at the same time they were decidedly wilder and much more wary than the Whimbrel and would try to lure us from their nests by alighting in front of us, piping loudly and then flitting off in the opposite direction to that in which their nest lay. We were very much interested to find from the very large series of eggs we were able to examine, that the oft-repeated assertion that it is comparatively easy to distinguish between the eggs of the Bar-tailed and Black-tailed Godwits, is not correct. In size the eggs of the two birds overlap considerably, the texture is in no way different, whilst the colour is a totally unreliable guide, as every range of colour to be found in the eggs of the Black-tailed Godwit is also to be found in those of this species. On an average of course the eggs are very much smaller, that of 111 eggs being 53·4 × 37·3 mm.

Habits.—This Godwit is common on the coasts of Sind in the cold weather and of course also occurs on the Mekran Coast. Most birds arrive in August and September, leaving again the following April but, occasionally they come in much earlier and Ticehurst has recorded them as early as the 22nd of July. He also notes that the birds may be seen both singly and in small flocks in the grey non-breeding dress but those which are purposing to migrate, have mostly attained their semi or complete summer plumage. As with others of the larger waders, the birds which stay the summer through are probably young of the previous year who are not breeding, but it is remarkable that one bird obtained by Ticehurst on the 20th of April was in full breeding plumage with the exception that it had retained some traces of its juvenile colouration in the tertiaries; so, occasionally at all events, some birds do attain this plumage the first year. Ticehurst also records the fact—and this is also endorsed by Eates and other observers—that the majority of the birds on arrival in Sind are still in complete breeding plumage, which they at once begin to moult for their winter attire. In India it seems to be purely a bird of the coastal region, and it may be found some way up the mouths of the larger rivers, especially where these have brackish water and extensive mud banks. They are extraordinarily shy, wild birds and very difficult to approach, the more so in that they invariably seem to keep to wide open spaces; moreover, they are generally to be found feeding and wandering about in mud, generally of some depth and sometimes unpleasantly treacherous. Their call is a pleasant low whistle, or, as Hume describes it—‘ a low piping note.’ Sometimes this is rapidly repeated, more especially if the bird is frightened, but as a rule it is a single note, uttered as the bird rises and again as it descends. Their courtship song is perhaps less musical than that of some of the smaller waders, but it is quite sweet and soft, consisting of rapidly uttered notes, not unlike their winter cry, but softer. The flight, of course, differs in no way from that of the Black-tailed Godwit, whilst its food appears to be the same. The birds examined by Hume had fed chiefly ‘ on tiny shrimp-like things, small mollusca, sand worms and insects, but most of their stomachs contained matter that I took to be minute acephalæ, or jelly fish. I found no vegetable matter in any of their gizzards, and the flesh of two or three that we cooked, hoping to find them as good as the other species, was by no means well flavoured. It was not fishy, but it had a faint, froggy flavour, and reminded me of that of eels caught in muddy broads and dykes at home.’

My own experience of the Godwit as a table bird does not agree with Hume’s description for I have invariably found them to be excellent in every way, more like snipe than anything else and generally very fat and tender.

GENUS : LIMNODROMUS.

Limnodromus Neuweid., Beitr. Naturg. Brazil, iv, Abst. 2, p. 716 (1833).

Type by mon., *Macroramphus griseus* Gmelin.

In this genus the bill is like that of a Snipe, very long, straight and slender, swollen towards the tip, where it is pitted ; both mandibles grooved at the sides from the base to the swollen dertrum, which has a groove on the upper surface ; the tarsus is shorter than the wing and is scutellated in front, reticulated behind ; the hind toe is well developed and the anterior toes are joined by webs, that between the middle and outer being the larger ; the wing is long and pointed, the first primary longest, the second almost as long. The breeding plumage is rufous, the non-breeding grey-brown, extremely like the plumage of *Limosa*. Sexes alike. Of the two species known, one is American and the other is from North-Eastern Asia.

LIMNODROMUS TACZANOWSKIUS.

The Snipe-billed Godwit.

Micropalama taczanowskia Verreaux, Rev. et. Mag. Zool. p. 206, pl. xiv (1860) (Dauria).

Macroramphus semipalmatus,—Blanf. and Oates, iv, p. 257.

Limnodromus tacznowskius, Stuart Baker, Fauna B.I., Birds, vi, p. 210, 1929.

Vernacular Names.—None recorded.

Description : Breeding plumage.—Whole head, neck and lower plumage rufous ; lores and a line through the eye so closely tipped with black as to appear uniformly of that colour ; a line from the forehead and crown closely streaked with black, leaving a rufous line or supercilium on either side ; hind-neck lightly streaked with black; mantle rufous, each feather broadly centred black, the scapulars, inner secondaries and small coverts edged with grey; lower back and rump white with black centres; upper tail-coverts barred black and white, the longer suffused with rufous; tail barred dark brown and white, the terminal bars blurred and broader; least wing-coverts dark brown; median and others grey-brown-edged with white; quills brown with white shafts, a long wedge-shaped white patch on the inner webs of the first five and extending to both webs on the others; outer secondaries grey-brown with broad white edges; posterior flanks lightly barred with black; axillaries and under wing-coverts white with a few dark brown bars.

Colours of soft parts.—Iris dark brown; bill black, paler and plumbeous at the base; legs and feet dark plumbeous or brownish-black.

Measurements.—Wing, ♂ 160 to 172 mm., ♀ 163 to 177 mm.; tail 61 to 67 mm.; tarsus, 48 to 54 mm.; culmen, 77 to 87 mm.

In Winter the upper parts are dark, rather greyish-brown each feather edged with white, most conspicuously so on the median and greater coverts; the under plumage is white, the sides of the head, chin, throat, neck, breast and flanks speckled with dark brown, the specks becoming bars on the lower breast, flanks and under tail-coverts.

Distribution.—The Snipe-billed Godwit breeds from West and Central Siberia through Mongolia to Japan. It has been obtained by Jerdon in Madras, by Blyth and Hume in Calcutta, by Oates in Pegu, by McMaster at Rangoon, by Macdonald in Dibrugarh and by Wilson in Shillong, in Assam, but doubtless it occurs far more often than it is recognised and shot. Butler recorded it from the Malay States.

Nidification.—The Snipe-billed Godwit breeds in Western Siberia, where its nest and eggs were taken by Dr. Valizkamen in the District of Barnaul. This is a Settlement of some size on the Ob River at a latitude of about 53°40′. The two eggs referred to were eventually obtained and given me by the late Dr. Paul Sushkin and are now in my collection; they are like small eggs of the Common Godwit, rather long pointed ovals in shape, with a pale dull buff brown ground and fairly numerous specks and small blotches of inky brown with a few faint underlying marks of neutral tint. They measure 47·6 × 32·3 mm., and 48·4 × 33·1 mm., and were taken on the 19th of June, 1918. I can find no other record of this bird's breeding, though Emile Smirnoff includes the eggs of this Godwit amongst those said to be in his collection.

Habits.—This wader has been found at odd times within our limits over very widely spread areas, as already shown above under the heading *Distribution.* As regards its habits in India, there is absolutely nothing recorded. The bird shot by Wilson in Shillong was in company with a few others on some small wet rice-fields at an elevation of over 5,000 ft., but all the other birds recorded in India have been obtained on the coast or on the muddy banks of the estuaries of the larger rivers. Wilson's birds were probably migrating, for on two other occasions I have seen this Godwit in Assam, once in early September on a marsh, on which were an enormous number of recently arrived snipe and other waders, with whom these birds had presumably come. We had shot over this swamp the previous day and had not seen 50 snipe, yet the following day when we shot the Godwit, snipe were present in many hundreds, accompanied by a vast number of small waders of many kinds. Two days later, practically the whole of them had left.

On the second occasion I saw them it was late April and all the waders were rapidly moving north towards their breeding grounds, two or three Snipe-billed Godwits among them. On both the occasions I saw these birds, they were walking about and feeding on masses of floating seaweed, over which one could walk, although all the time at some risk of our feet going through the floating weed into the deep water below. The flight resembled that of the Bar-tailed Godwit but was, I think, even swifter and certainly more direct. As far as I can recollect, they uttered no note of any kind but other waders were so numerous and so frequently calling that it would have been easy to have missed hearing these birds had they called.

(*To be continued.*)

REVISION OF
THE FLORA OF THE BOMBAY PRESIDENCY.

BY

E. BLATTER, S J., Ph.D., F.L.S.

PART XVIII

(*With 4 plates and 1 text-figure.*)

(*Continued from page 495 of this volume*).

ORCHIDACEÆ

BY

E. BLATTER, S.J., Ph.D., F.L.S. & C. McCANN, F.L.S.

28. SACCOLABIUM Blume (not in Cooke).

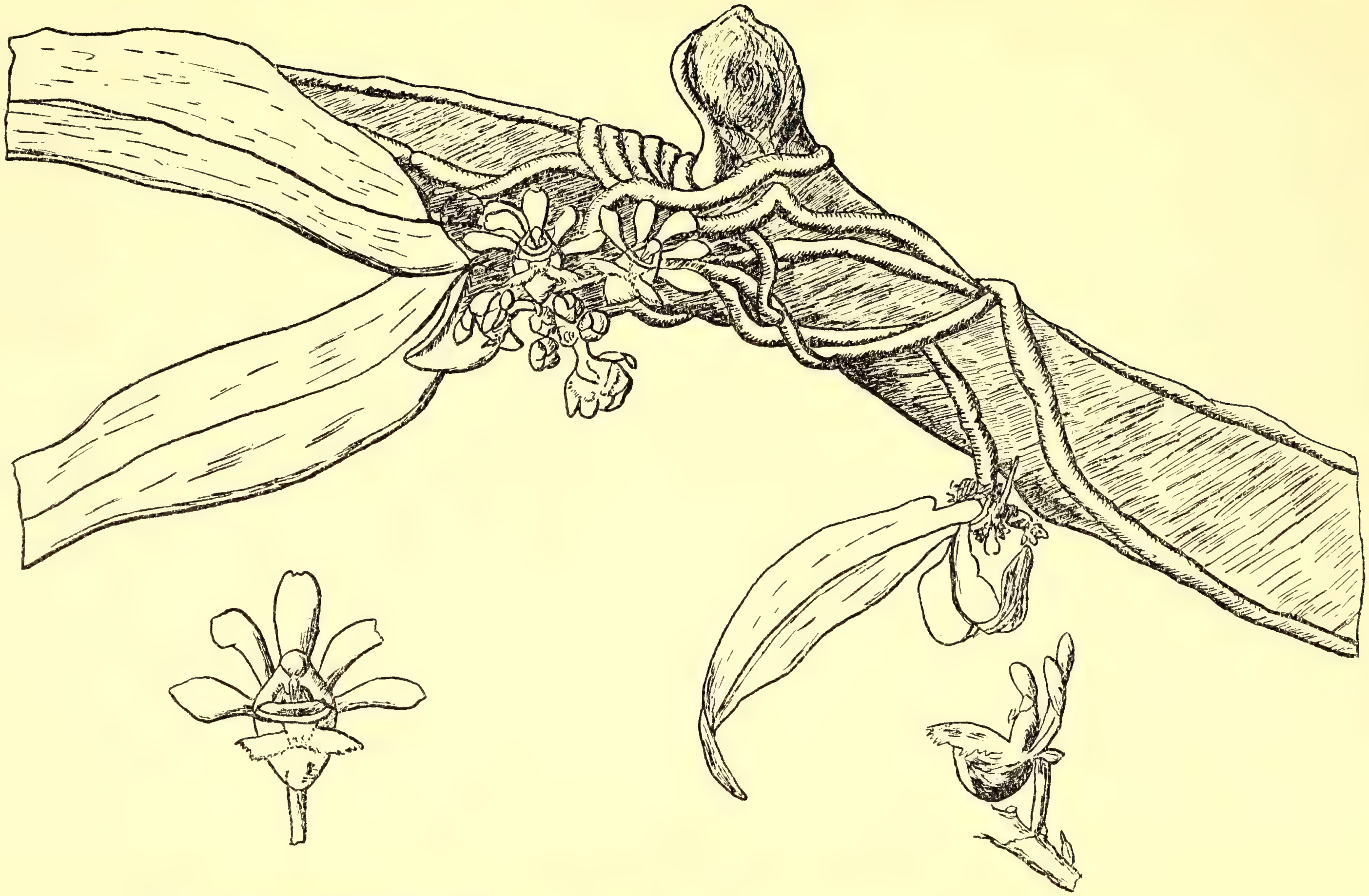
Epiphytic herbs; stems leafy. Leaves long, linear, sometimes terete. Flowers solitary or in simple or branched, few- to many-flowered racemes, small or moderate sized. Sepals and petals free, spreading, recurved or incurved. Lip spurred, 3-lobed, rarely entire, side lobes short, erect, midlobe fleshy, spur saccate, naked within, or with calli on the front wall only. Column short and broad; foot 0 or indistinct. Anther 1- or imperfectly 2-celled; pollinia 2, entire or 2-partite.

Species a few.—Indo-Malayan.

Saccolabium flabelliforme *sp. nov.* Blatter & McCann.

[*Affinis Saccolabio pulchello* Fischer *a quo tamen differt foliis latioribus acutis minime bilobis, floribus multo maioribus, sepalis petalisque flabelliformiter dispositis labio albo ad basim angulo profundo triangulari flavo ornato, lobis labii lateralibus nullis.*]

Description: A small plant; stem very short, arising from beneath the leaves; roots very long, flattened, bluish grey, clinging to branches of trees. Leaves linear or linear-oblong, acute, flat, up to 12 cm. long and about 2–3 cm. broad. Flowers sessile (i.e. ovary not stalked) in few- (usually 6-) flowered racemes, 18 mm. wide by 12 mm. across; bracts broadly ovate, 1 mm. long 2 mm. broad at base, thin, brown. Dorsal and lateral sepals and petals arranged like a fan; sepals and petals apple-green, sometimes with a rose-coloured dot; dorsal sepal oblong-obovate, slightly emarginate and apiculate, 9 by 4 mm.; lateral sepals spathulate-oblong, obtuse, slightly concave, 8 by 3 mm. Petals resembling the lateral sepals, but slightly smaller, slightly concave, 7 by 2 7 mm. Lip without side lobes, 3 mm. long, 8 mm. broad, curved at its extremity with the straight hinder margin as a base (the hinder margin being made up by the straight front edge of the opening of the spur and a short free portion on each side set onto the outside walls of the spur slightly below its edge), slightly deflexed, outer edge minutely fimbriate, tip emarginate, pure white, except the thickening of the spur which is greenish; there is a central deep yellow triangle on base of lip, and the bottom of the spur is similarly coloured, the yellow triangle of lip is bordered with rose-coloured dots and short lines. Spur nearly hemispherical, slightly laterally compressed, with a longitudinal, outwardly convex, inwardly concave thickening, length and side diameter 5 mm., the free lateral edges of the spur slightly ascending outwardly from base to column, the free edge of the spur-cavity marked thinly with purple-rose, and the interior bottom of spur dotted with similar coloured spots. Column white, generally strongly suffused with deep rose, without foot, as broad at base (2 mm.) as the front edge of spur where the lip commences, and about as high as it is broad there, triangular in shape seen from the front, the apex rather broadly rounded, the cap oval, pointed in front, convex with depressed margins, yellow, anticous or inclined (it forms the top of



Del. C. McCann after Miss E. Bell.

Saccolabium flabelliforme Blatter and McCann, *sp. nov.*

the column), slanting down towards opening of spur. Pollinia 2, orange-yellow, oval, attached to a caudicle as long as the diameter of both together ; gland oval, with a bifid tip which is always visible outside the cap lying on the rostellum and which hides completely the stigmatic hollow. The front-opening leading to the stigmatic hollow triangular owing to the flanged front-walls of the column. Ovary in flower 8 mm. long.

Locality : N. Kanara : Devimane Ghat (Sedgwick & Bell 6957 ! type) ; Yellapur (T. R. Bell, from sketches, coloured plates and MS. notes) ; Sirsi, in evergreen (Sedgwick 7078 !) ; in forests (T. R. Bell 5424 ! 5413 !).

Flowers : September 1915 (Yellapur) ; October 1914 (Sirsi).

29. NERVILIA Comm. ex Gaud.

(Under *Pogonia* in Cke. II, 706).

Terrestrial, tuberous, 1-leaved. Leaf mostly appearing after the flowers, broadly cordate to orbicular, plicate. Flowers solitary or few to many, racemose. Sepals and petals subequal, narrow. Lip inferior, adnate to the base of the column, sessile or almost clawed, entire, 2-fid or 3-lobed, sometimes slightly saccate at the base. Column elongate, broadening upwards ; foot 0. Anther substipitate ; pollinia 2, 2-fid, or 4, powdery ; caudicle and gland absent. (ex Fischer).

Species 45.—Tropics of the Old World.

The Bombay species have been put under *Pogonia* Juss. by Cooke. *Pogonia*, with its 40 species is, 2 Chinese-Japanese species excepted, a New World genus.

Cooke mentions 2 species from the Presidency which when put under *Nervilia* have to be called *N. plicata* Schlechter and *N. carinata* Schlechter. To these we add 3 species not known from the Presidency before and 4 new ones.

Hook. f. in his F. B. I. vi, 119 refers to the difficulty he experienced in analysing the species from Herbarium specimens and adds that ' all require revision.'

We have had the advantage of exceptionally well-prepared specimens of leaves and flowers of several species and, in addition, excellent drawings and paintings by Miss E. Bell. Besides, Mr. T. R. Bell was kind enough to put at our disposal his detailed descriptions which he had drawn up from live specimens.

We feel confident, though we are not absolutely sure, that the new species are all good ones. Hooker's descriptions are rather meagre and Wight's illustrations are not always perfect. But taking it for granted that the details given by Hooker are correct, we are allowed to say that the species described below are good. If, however, one or the other is not and if other botanists should think that they should be combined with one of the older ones, our descriptions will at least serve the purpose of furnishing many details which were not known before.

As to the time of appearance of the leaf Hooker f. states (and Schlechter and Fischer agree with him) that all the species of the genus *Nervilia* leaf after flowering. This is not always the case.

I. Scape 1–flowered
  1. Sepals and petals greenish white, sometimes with a rosy shade. Lip broadly saccate, pinkish white ... ... 1. *N. monantha.*
  2. Sepals and petals light maroon-green on back, dirty green inside. Lip very slightly saccate at base ; tube light apple-green, midlobe white suffused with rose ... 2. *N. infundibulifolia*
  3. Sepals and petals greenish purple. Midlobe of lip obovate, pink, mottled with purple... 3. *N. Hallbergii.*
  4. Sepals and petals green. Midlobe of lip rhombic-lanceolate-acuminate from a narrow hairy base ; disk white mottled with pink ... ... 4. *N. juliana.*

II. Scape 2-flowered. Flowers 30–35 mm. diam. Lip pale pink ... . 5. *N. biflora.*

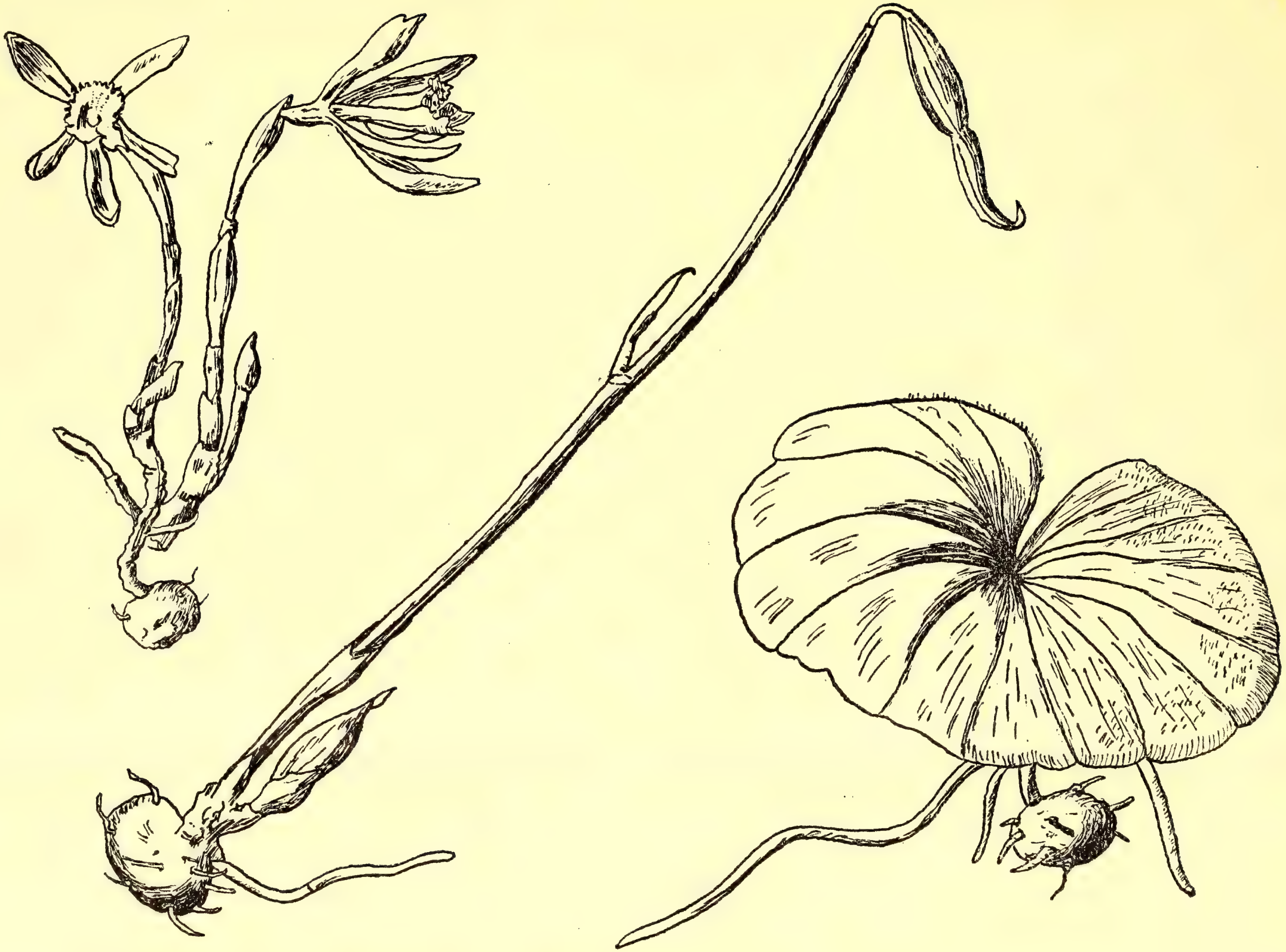
III. Scape 2-3-flowered. Lip lilac with a green spot at the base and a yellow line along the thickened part of the midrib ... ... 6. *N. plicata.*
IV. Scape several-flowered. Flowers 14 mm. long, green, except for lilac markings on lip ... 7. *N. hispida.*
V. Scape many-flowered
  1. Leaf 13- or more-ribbed ... ... 8. *N. Aragoana.*
  2. Leaf 7-9-ribbed ... ... 9. *N. carinata.*

1. **Nervilia monantha** *sp. nov.* Blatter & McCann.

[*Orchidacea appropinquans Nerviliam julianam* Schlechter *a qua distingui potest folio generatim largiore, sessili vel subsessili, obtuso, multinervoso* (11–19), *flore multo minore, sepalis petalisque linearibus albo-viridibus roseonervosis labii forma distincta colore roseo-albo. Differt a N. plicata* Schlechter *folio viridi, flore unico, colore et forma labii ; a N. biflora* Schlechter *flore semper unico, labio minime glabro, columna distincta.*]

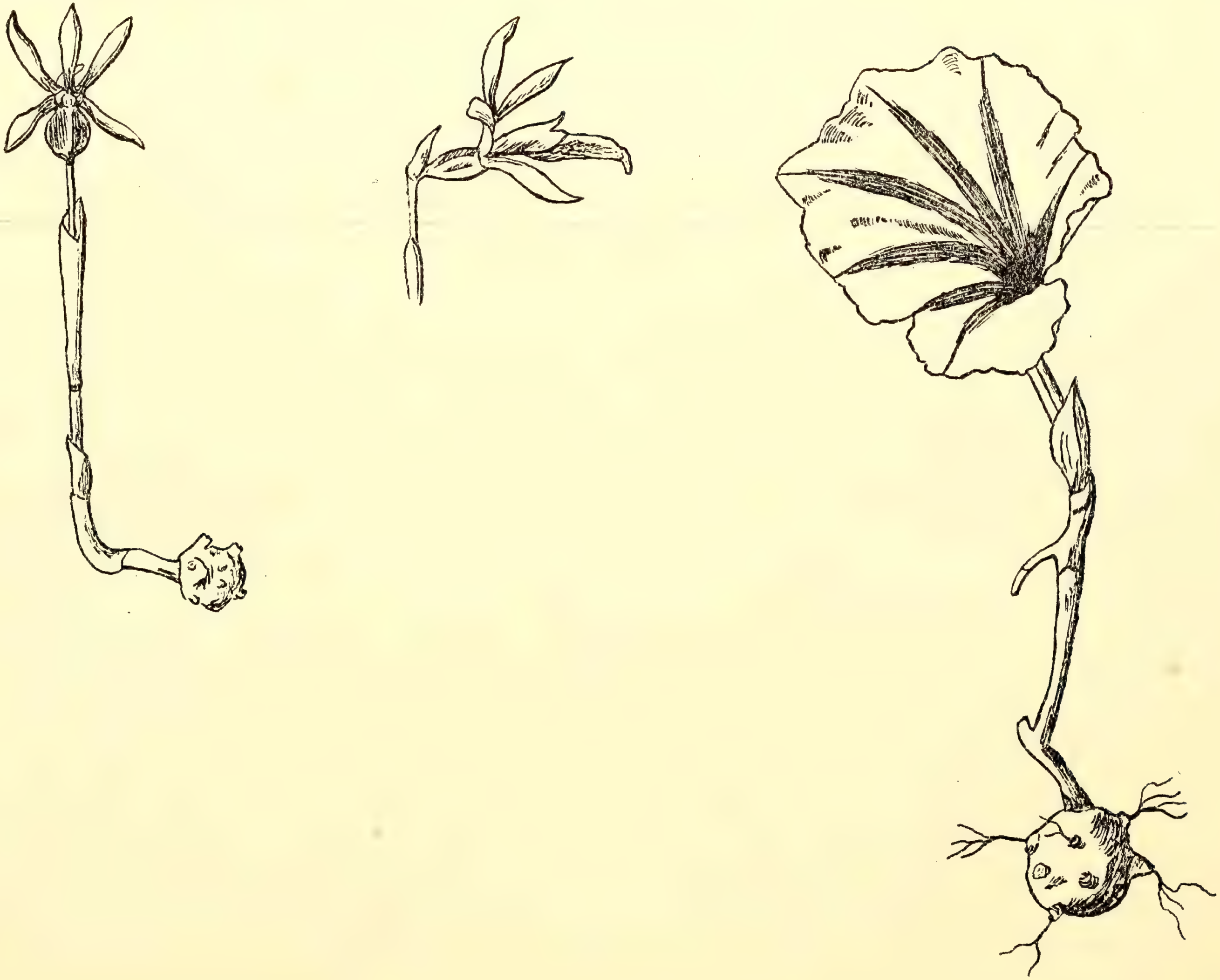
Description : Tuber subglobose, 25 by 15 mm. or less, depressed above and below, giving off sparse little roots from surface all over, yellowish white, generally 5–10 cm. underground. Two or three stolons from stem between tuber and origin of leaf. Leaf sessile or subsessile, lying flat on the ground and appearing after the flowers, orbicular-cordate, obtuse, with a broad or narrow sinus at base, 11-19-nerved, the size varying between 2 and 10 cm. diam., pure green throughout, upper surface velvety when first expanded, with short fine glandular white hairs, glabrous below. Flowering-stem 7–10 cm. long, fruiting-stem reaching 15–20 cm., very slender, always 1-flowered, light pink, with usually 2 long, wide-mouthed acuminate sheaths, these shorter than the internodes, lighter pink with 7 purplish nerves. Floral bract triangular, subulate, short, not concave, longer than broad, generally 1–1·5 mm. in length, whitish with a green shade, edges reddish. Flowers erect or suberect. Sepals and petals similar to each other in shape and colour, linear-acute, slightly narrower at base than in the middle, greenish white, sometimes with a rosy shade, the nerves rose-coloured. Sepals 5-nerved, 17 by 3 mm., concave, the midvein not particularly prominent on back. Petals hardly shorter, 3 mm. broad, 3-nerved. Lip hardly saccate, 18 mm. long, the lower ¾ tubular, 4 mm. broad in middle, about 2 mm. at base, pinkish white, hiding the column, the edges hardly conniving, widening from base upwards, the lower part afterwards produced into a short deflexed terminal lobe which is very wrinkled both round the margin as well as longitudinally in the limb with the margin shortly fimbriate, separated by a deeper cut from a broadish, fimbriate (not always), smaller, 2 mm. long lobe on each side forming the end of the tubular part of the lip, the throat of the tube stretching some way up each side lobe and some way down the tube beset with white soft hairs ; lip 7-nerved with other veins outside the exterior ones, the 3 central nerves with a row of purple-pink tubular outgrowths which are simple at the beginning and become longer and branched towards the distal end ; the nerves themselves purplish rose, the central nerve light brownish. Column galbrous, stalk quite straight, the anther leaning slightly forward ; stalk thickened to contain the stigma which is semi-elliptical, longer than broad, somewhat pointed below, straight at top below anther ; edges of anther fairly prominent, the back convex, very slightly keeled down middle, the cap tilted forward a good deal, reaching far above the edges, rather square in form, though longer than broad, sometimes broader across top than at front, depressed down centre at top ; the anther-pockets occupying the whole of the bottom which is here at right angles to the front face ; the pollinia attached behind, or rather lying with their bases towards the back, these bases dark purple and globular, the pollina yellow ; the pockets are parallel and straight. Length of column 9 mm.; breadth of stalk nearly 1 mm.; breadth of anther a little less than 2 mm., the part of top of column containing the stigma 2 mm. Fruit spindle-shaped with 6 longitudinal ridges ; these ridges broad, prominent and rounded in transverse section, 21 mm. by 7 mm., the beak 8 mm., thick and conical, with the withered lip showing as an extra thin point beyond ; it is pure green in colour as is also the beak, generally deflexed.

The leaf appears above ground as a thick, short, spindle-shaped bud, covered by a sheath, 25 by 8 mm., pointed. (Chiefly from T. R. Bell's MS. notes drawn up from live specimens).



Del. C. McCann after T. R. Bell and Miss E. Bell.

Nervilia monantha Blatter and McCann, *sp. nov.*



Del. C. McCann after Miss E. Bell.

Nervila infundibulifolia Blatter and McCann, *sp. nov.*

Locality : N. Kanara : Yellapur (T. R. Bell 5428 ! type, 5428a ! 5429 5434 ! 2522–2524 !) ; Nagargali (Sedgwick 2635 !) ; Karwar (T. R. Bell 4071 !).—Bell found this species very common in 1911 at the beginning of June after rain round Yellapur in jungle, preferring apparently bamboo jungle where the ground is covered with dead leaves. He found it also in the compound of the D. F. O. bungalow under *Pithecolobium* trees. It is always found under shade and generally comes up in groups.

Flowers : June 1911 (Yellapur).

2. Nervilia infundibulifolia *sp. nov.* Blatter & McCann.

[*Orchidacea similis aliquomodo Nerviliae monanthae* Blatter & McCann, *sed facile distinguitur folio infundibuliformi, paucinervoso* (5-7-9) *petiolato, sepalis* 3-*nervosis, petalis* 1-*nervosis, labii lobo medio integro polliniis albis.*]

Description : Tuber about 12 mm. in height, slightly flattened above and below yellowish white, buried 3-8 cm. underground, covered sparsely with little root-knobs. The stolons, if any, arise not from the tuber but from the stem below the origin of the leaf. Leaf-bud spindle-shaped, 15 by 3 mm., pointed. Leaf solitary, appearing after ripening of fruit, broadly cordate, funnel-shaped, about 3-4 cm. diam., margin crimped, irregularly and minutely dentate-crenulate, 5-7- or rarely 9-nerved, the last pair generally thin, green with broad deep purple-maroon streaks from base along the depressed nerves, broadening towards the middle, narrowing again towards extremity but not reaching the margin, the margin very finely brown-maroon. Petiole dark brown-maroon, embraced at base by a 5-nerved, membranous, oblong-acuminate sheath which is light brownish and has the nerves purplish, the petiole has as many prominent ridges as the limb has nerves and the ridges are continuous with them. Flowering-stem 7-11 cm. high, straight, consisting of 2 internodes ; upper sheath of scape about 3 cm. long, linear-oblanceolate, acute, wide-mouthed, 5-nerved, with an extra marginal one ; lower stem-sheath much shorter than the upper , stem and sheath maroon-coloured. Flower 1, generally at a right angle to the axis or slightly inclined. Floral bract generally 3 mm. long, but may reach even 7 mm., about 2 mm. in width, 3-nerved, acute or acuminate, concave, maroon-coloured, the veins darker. Sepals and petals similar, linear-oblanceolate, acute, slightly concave, light maroon-green on the back, dirty green inside, the nerves maroon-red. Sepals 3-nerved, 13 mm. in length, 3 mm. broad where broadest. Petals 1-nerved, 12 mm. in length, 2 mm. broad where broadest. Ovary lowly 6-keeled, each more prominent central keel being flanked on each side by a much lower one, maroon-red. Lip very slightly saccate at base, tubular for half its length or slightly less, narrowest just above sac, thence increasing forwards, the edges hardly connivent, parting to show anther slightly, ending on each side in a triangular, rather blunt lobe which overreach in length the column and anther, produced below into the midlobe which is in the same plane as tube, broadly ovate, the margin nearly entire (shows signs of unevenness), the lateral margins deflexed, the extremity rounded, the midvein somewhat broadly gibbous, especially towards the end, though not very prominent (roundly convex in transverse section), beneath channelled along midvein, deeply and narrowly so just before extremity. Length of lip 17 mm., breadth just above sac 2 mm. (less across for the tube is higher than broad), at mouth 3 mm. ; the side lobes very slightly spreading, about 15 mm. ; long, equilaterally triangular ; the midlobe 10 by 7 mm. ; the ovary about 4 mm., the pedicel 2 mm. Colour of lip light apple-green for the tube, the side lobes lighter, the midlobe white suffused all over with rose (with a maroon shade in it, medium light in shade) in irregular lighter and darker patches or spots, the midvein for ⅔ of its length and the margins narrowly white. Column straight, the anther, and (stigma, i.e., the enlarged top half) leaning back, the stalk half the total length, flat in front, rounded behind, covered with short, soft, white hairs for half its length below the stigma on its flat front surface ; stigmatic cavity large, occupying nearly half the length of the whole, oval, longer than broad and slightly narrower below than above ; the cap occupying the whole top of column, horizontal, the edges of the anther (top of column) only very slightly embracing it, this cap being square when seen from above, concave transversely, straight along front edge above stigma, higher behind than in front ; the pockets beneath straight, parallel, containing each one pollinium, lamellated, shaped like a broad sign of exclamation. Column about 8 mm., the breadth of stalk 1 mm., of anther 2 mm. ; the cap hides the whole top of column. Colour of column light apple-green, of anther whitish, the cap just touched with maroon along its front edge; there are sometimes a few fine longitudinal red streaks on stalk and back of anther; the pollen masses are white. Fruit 6-ribbed, the ribs wide with a more prominent central ridge, beaked with the persistent floral envelope, the column, petals and sepals closely embracing it, the withered end of lip generally protruding as a point from the tip of the beak (the sepals and petals close round the column) completely forming an end cone pointed at extremity. Capsule 11 by 5·5 mm., oblong-oval, the beak another 15 mm. (Chiefly from T. R. Bell's M.S. notes and paintings by Miss E. Bell.)

Locality : N. Kanara : Yellapur (T. R. Bell).—Usually found in places where there is a covering of dead leaves.

Flowers : June 1911.

3. **Nervilia Hallbergii** *sp. nov.* : Blatter & McCann.

[*Orchidacea referens Nerviliam julianam a qua differt labii lobis lateralibus integris, lobo medio obovato et basi minime pubescenti necnon colore.*]

Description : Tuber globose, warted. Leaf not seen. Flowering-stem about 10 cm. high, 1-flowered, consisting of 2 internodes, each with a long linear-acuminate sheath, the upper larger. Flower nodding, bract minute. Sepals and petals spreading, subequal, narrowly lanceolate, greenish purple; midlobe of lip obovate, rounded at tip, pink, mottled with purple, provided with a central white, linear callus; lateral lobes falcate, whitish, folded round stalk of column; no sac or spur. Column pink; anther loose in tube. Pollinia not observed.

Locality : W. Ghats : Kuna near Khandala in jungle (Hallberg, photograph and specimen in formaline at St. X. C., Bombay).

Flowers : June 1917.

4. **Nervilia juliana** Schlechter in Engl. Jahrb. xiv (1911) 402.—*Epipactis Juliana* Roxb. Fl. Ind. iii (1832) 453.—*Pogonia juliana* Wall. Cat. 7399; Hook. f. F.B.I. vi, 119; Trim. Fl. Ceyl. iv, 225.

Description : Tubers globose, 12-25 mm. diam., white; stem 5-8 cm., white, erect; roots few, vermiform arising above the tuber; leaf solitary, developing after the flowering of the scape, petioled, broadly ovate-cordate, acute, about 5 cm. diam., membranous, plicate with 5-7 veins, radiating from the top of the petiole, green or purplish beneath; petiole short, with a few acute sheaths at the base; scape 12-15 cm., with several convolute sheaths, the upper longest. Flower solitary, shortly pedicelled, 2·5 cm. broad; bracts shorter than the ovary. Sepals and petals narrowly lanceolate, acuminate, green; lip longer than the sepals, side lobes small, narrow, falcate, oblong, toothed, white, terminal rhombic-lanceolate-acuminate from a narrow hairy base, white, mottled with pink; disk pubescent between the lobes.

Locality : N. Kanara, in forests (Bell 5437 !).

Distribution : Assam, Sylhet, Lower Bengal, N. Kanara, Ceylon.

5. **Nervilia biflora** Schlechter in Engl. Jahrb. xiv (1911) 403; Fischer Fl. Madras pt. viii (1928) 1459; Hook. Ic. Pl.—*Pogonia biflora* Wight Ic. t. 1758; Hook. f. F.B.I. vi, 119.

Nervilia biflora is very incompletely known. Apparently it has been found only once, in the Wynaad jungles of the Madras Presidency. The leaf is not known at all, and as to the floral details we have practically only Wight's illustration. We take our specimens from N. Kanara to be this species. They agree in nearly all details with Wight's and Hooker f.'s diagnosis, except where Hooker f. says that the midlobe is crisped and that the sepals and petals are white. Our sepals and petals are light brownish-yellowish with a green shade.

In the meantime Mr. C. E. C. Fischer of Kew Gardens has been kind enough to compare our specimens with the type specimen in the Kew Herbarium. He and Mr. Summerhayes who is in charge of the Orchids of the Herbarium are agreed that our plant is *Nervilia biflora*. A description with drawings has been published in the Ic. Plant. As this work is accessible to few only, we repeat the description in this place.

Description : A stout terrestrial plant. Tuber white with sparse little rootlet-knobs, globose, 17 by 15 mm.; portion of stem between tuber and base of leaf-stalk very short, about 3-4 cm. Leaf ovate-cordate, acute or acuminate, plicate, many-nerved, spread on the ground, shortly stalked or almost without stalk, brown-maroon, hairy all over on the upper surface, about 8 cm. long and 6 cm. broad. Flowering stem growing from the sinus of the leaf which lies flat on the ground, 8-10 cm. long, lengthening after flowering to 15-23 cm., greenish white below, and where it is covered by sheaths, becoming, together with ovary, brown-maroon with a green shade towards top; sheaths 2 in number, corresponding to the internodes, about the length of the internodes, linear-obovate-acuminate, 9-veined, soiled greenish white with a brownish shade, the veins darker greenish; internodes ribbed. Flowers 2, one above the other, 30-35 mm. diam. Floral bracts variable in size, 3-6 mm. long, slightly concave, more or less equilateral-triangular, usually entire, sometimes with small teeth at apex, showing signs of longitudinal veins, colour of sheaths. Sepals and petals spreading, similar, narrowly oblanceolate-acute or acuminate, light brownish-yellowish with a green shade. Sepals 27 mm. by 4 mm., somewhat concave, midrib prominent on back, 7-nerved. Petals 23 mm. by 3 mm., 5-nerved, outside nerves sometimes indistinct. Lip slightly saccate at base, tubular for nearly ⅔ its length, embracing the column completely, narrowest just above basal sac, then gradually widening, the edges closely conniving, pressed against each other forming a keel, then separating gradually and opening wide into the terminal lobe which is really the mouth of the tube widened out obliquely, the contour rounded, very slightly emarginate at end, the margins very shallowly and slightly dentate-crenulate, the midvein prominent and swollen, impressed on the underside leaving the limb inflated on both sides. Length of lip 18 mm., breadth in centre 5 mm., diameter of tube at origin 2 mm. When the lip is flattened out its shape is nearly elliptical with 2 very short insignificant side lobes at about ⅔ from the base. Colour of lip rose pink, lighter at base and along conniving edges of tubular part, veined darker from midvein outwards, the midvein somewhat broadly white. Column erect, stalked, slightly broader than thick, somewhat concave down front, curved twice, once forward at base, then backwards in upper part. The stalk widens just below anther to contain the concave, transversely elliptical stigmatic surface which occupies about ¼ of the stalk-length; the anther above it, about the same width, leaning slightly forwards, straight on its front edge, convex behind with a slight keel down middle, the sides produced upwards slightly higher than the cap which is situated in such a way that this convex part of the column with the keel is visible from above behind it; the cap rather square, convex behind, depressed centrally towards front; pollinia-pockets beneath slightly S-shaped, long, occupying ⅔ of the length; pollinia lying with their bases forwards, two in each pocket, longly oval, pressed against each other in each pocket, composed of many lamellae; colour of column whitish-rose, the cap rose, red in front, the pollinia-pockets white, pollinia yellow. Length of whole column including anther and cap 10 mm; breadth of anther 2 mm. No sign of hairs on the column. Fruit spindle-shaped, 6-ribbed, the ribs broad and low, winged along the prominent middle lines, 16 mm. long by 8 mm. broad (across the ribs), the beak of sepals and petals another 18 mm., the withered lip showing as a thin point beyond again.

The leaf appears above ground as a very thin bud, about 17 by 4 mm. and pointed; after thickening rapidly it expands in a very short time.

Very often only one fruit develops on each stem. The plant is gregarious and is nearly always found amongst dead leaves.

Locality: N. Kanara: Yellapur, behind the forest Naka around the root of a tree in jungle, amongst dead leaves (T. R. Bell 6065 ! 6066 ! ter); Tatwal, in large dense jungle (T. R. Bell in MS.); Sirsi (T. R. Bell in MS.).

Flowers: May 1912 (Sirsi); May 1919 (Yellapur); July 1910 (Tatwal).

Fruit: July 1911 (Tatwal).

6. **Nervilia plicata** Schlechter in Engl. Jahrb. xiv (1911) 403; Fischer Fl. Madras pt. viii (1928) 1458.—*Pogonia plicata* Lindl. Gen. & Sp. Orchid. (1840); Hook. f. F.B.I. vi, 119; King & Pantl. in Ann. Roy. Bot. Gard. Calc viii (1898) 268, t. 358; Cke. ii, 707; Prain Beng. Pl. 1025; Brühl Orch. Sikkim (1926) 157.—*Epipactis plicata* Roxb. Fl. Ind. iii (1832) 454.—*Arethusa plicata* Andr. Bot. Reg. t. 321.

Description: Cke. ii, 707.

Locality: Konkan: Malabar Hill in Bombay Island, Millard's garden (Millard 16723 ! in H. St. X. C.).—*W. Ghats:* Khandala (Cooke !); Lonavla (H. St. X. C. 26510 !).

Flowers : June 1892 (Lonavla).

Distribution : Konkan, W. Ghats of Bombay Pres., Madras Pres. : Rampa Hills. 1,500-2,000 ft. Mysore, Travancore, Sikkim, Bengal.

7. **Nervilia hispida** *sp. nov.* Blatter & McCann.

[*Orchidacea vicina Nerviliæ Aragoanæ* Gaud., *necnon N. carinatæ* Lindl. *a priore tamen differt folio multo minore et dense hispido pilis minutis albo-tuberculato, scapo breviori, floribus minus numerosis et cum folio coætaneis, labio basi aliquantulum saccato, colore viridi, ab altera tamen petiolis multo longioribus, folio hispido nervisque multis prædito.*]

Description : Tuber globose, whitish, covered with sparse rootlet-knobs, 20 mm. broad by 17 mm. high. Leaf appearing at the same time as the flowers, broadly cordate, cuspidate, with a wide rounded sinus, thin in texture, finely hispid because of a dense covering of extremely minute, white, tubercular hairs, giving it a shagreened appearance, 4·5 cm. long by 5·3 cm. broad, 13-15 nerved from base, green, plicate between the nerves, margin entire, wavy, the nerves maroon towards base ; petiole 13 cm. long from tuber, 11 cm. above ground, maroon-brown in colour, with a narrow smooth rounded channel down the front, ribbed in continuation of nerves of blade. Scape including raceme 10-11 cm. high, 4·5 mm. thick, round, with many fine longitudinal ribs which are not prominent, green with a maroon tinge, except axis of raceme, several-flowered ; raceme about 5 cm. long ; internodes of scape 2, the lower slightly shorter, the sheath to upper 25 mm. long, shortly pointed, about 11-nerved, dirty light green with a brown shade. Bracts linear-oblong, acute, concave, 12-23 mm. long by 1·5-3 mm. broad, with about 7 nerves, slightly oblique. Flowers green, except for lilac markings on lip, 14 mm. long ; pedicel 3 mm. long, the wing-ridged ovary 3 mm. long. Sepals and petals apple-green, similar in shape, linear-oblanceolate, acute, 3-nerved, all somewhat concave. Sepals 16 by 5 mm. ; petals 15 by 5 mm. Lip very slightly saccate at base, tubular for 10 mm., the rest, 4 mm., being the midlobe, semicircular in outline, the apex mucronate owing to prolongation of midrib. The basal tubular portion is 2·5 mm. just above sac, 4 mm. at end where on each side is a short, rounded side lobe, separated from the midlobe by a shallow rounded sinus ; side lobes 1 mm. long, triangular-rounded. The midlobe has the margin curled up all round and is thus cupular, has 3 nerves down the middle beginning at base of lip, all 3 prominent beneath, the 2 side ones the more prominent above ; outside the side ones are veins running from them to margin of midlobe and tube ; all these veins, except the middle length one are set with soft, white fluff. Colour of lip apple-green, the midlobe having the space outside the 3 length-nerves lilac-coloured on the free exposed portion, the little veins from the side length-nerves to margin being also lilac as far as some way up the tube ; when not lilac all veins are darker green than the ground colour. Column whitish light green, the cap lighter and gently tinged with rose, the tinge darkest just at front border ; it is nearly straight, clavate at top, flat in front, rounded behind, quite smooth throughout except along the keel on the back of the anther where there is a line of small white hairs ; stigma shallow, transverse-oval, straight across top below cap and occupying about ⅕ of the whole column length ; side walls of anther thin and produced slightly upwards free of the cap, but not overreaching it and also out in front on each side of stigma ; half the thickness of top of column is visible behind the cap ; the cap lies inclined forward at 45°, is nearly square, slightly depressed down centre and produced forward at front edge. Length of column 10 mm., breadth 1·5 mm., the stalk being 6 mm of the total length ; anther 2·5 mm. in width ; cap about as broad as the stalk, i.e., 1·5 mm., but is, of course much thinner through ; anther pockets parallel, pollinia 2 in each pocket, shaped like a sign of exclamation, each pair pressed together, lamellate, very light yellow in colour. Fruit fusiform with 6 ribs along the whole length.

The tuber is generally 7-10 cm. below the surface in open places under trees as often as not, though also where there is a covering of leaves. The leaf and scape start from the same point of tuber. Later stolons arise from the leaf-base underground.

The leaf comes out at the time of flowering. It shows in the beginning as a somewhat thin bud with a sheath 2·5 cm. long ; sheath light maroon, 11-nerved, obtusely pointed and generally with the margins, when showing, thinly maroon. (From T. R. Bell's MS.)

Locality : N. Kanara : Yellapur (T. R. Bell).
Flowers and fruit : 15th June 1911.

8. **Nervilia Aragoana** Gaud. in Freyc. Voy. Bot. 422, t. 36; Fischer Fl. Madras pt. viii (1928) 1459.—*Pogonia flabelliformis* Lindl. in Wall. Cat. 7400; Gen. & Sp. Orchid. 415; in Journ. Linn. Soc. iii, 40; Hook. f. F.B.I. vi, 121; Duthie in Ann. Roy. Bot. Gard. ix, t. 125; Haines Bot. Bih. & Or. 1163.—*P. Nervilia* Blume Mus. Bot. i, 32.—*P. carinata* Wight Ic. t. 1720.—*Aplostellis flabelliformis* Ridley Fl. Malay Pen. iv (1924) 203.
Description : Tuber subglobose, white, about 2·5 cm. diam.; scape arising from the top of the tuber. Leaf ovate-acuminate or orbicular, cordate at base, 10-14 cm. diam., with 18-20 stronger nerves and as many or more finer intermediate ones; petiole 15-28 cm. long. Flowers green, 18 mm. long, spreading and drooping, up to 15. Sepals 15 mm. long, erect, connivent, lanceolate-linear, acute. Petals 12 mm. long, similar, but with faintly brown nerves. Lip very narrow, 12 mm. long, straight, neither saccate nor spurred, sometimes slightly gibbous, side lobes embracing the column, white, brown-veined; midlobe white, flat, projecting beyond the side lobes, ovate, but not constricted at base; palate hairy with 3 green veins. Column 8 mm. long. Ovary very short, 5 mm. long, winged.
Locality : Konkan : Neral (Herb. St. X. C. 26509 !).—*N. Kanara :* Sampkhand, 1,600 ft. (Bell & Sedgwick 6966 !).
Leafing : Aug. 1890 (Neral); Oct. 1919 (Sampkhand).
Distribution : Tropical Himalaya, from Garhwal 4,000-5,000 ft. eastwards, Malay Peninsula, Konkan, N. Kanara, Madras Pres.: Rampa, Pulney Hills; Travancore, Malaya, Siam.

9. **Nervilia carinata** Schlechter in Engl. Jahrb. xiv (1911) 404; Fischer Fl. Madras pt. viii (1928) 1459.—*Pogonia carinata* Lindl. Gen & Sp. Orchid. (1840) 414; Dalz & Gibs. Bomb. Fl. 270; Hook. f. F. B. I. VI, 121; Prain Beng. Pl. 1026; Hook. f. in Ann. Roy. Bot. Gard. Calc. v, t. 94; Duthie in Ann. Roy. Bot. Gard. Calc. ix, t. 124; Cke. ii, 707.—*Epipactis carinata* Roxb. Fl. Ind. iii (1832) 454; Grah. Cat. 205.—*Pogonia flabelliformis* Woodr. in Journ. Bomb. Nat. Hist. Soc. xii (1899) 519 (*non* Lindl.).
Description : Cke. ii, 707. A better description in Duthie Fl. Upper Gang. Pl. iii, pt. ii (1920) 217.
Locality : Konkan (Stocks).—*W. Ghats :* Lonavla (Herb St. X. C. 26508 !). *S. M. Country :* Near Dharwar (Law).—*N. Kanara :* Kulgi, 1,500 ft. (T. R. Bell 6088 !); without locality (T. R. Bell 4072 !).
Flowers : May 1919 (Kulgi); August 1891 (Lonavla).
Distribution : Sub-Himalayan tracts of Rohilkhand and N. Oudh, Kumaon, Bengal, Burma, Bombay Pres., Mysore, Pulney Hills, Cochin.

30. EPIPOGUM Gmelin (not in Cke.).

Saprophytic, leafless, brownish, terrestrial herbs; roots tuberous or coralloid; stem erect, sheathed. Flowers laxly racemed. Sepals and petals subequal, narrow, free, erect or spreading. Lip sessile at the base of the column, broad, entire or 3-lobed, spurred, disk with rows of papillae. Column short; foot 0. Anther thick, dorsally 2-celled; pollinia 2, each with a long, filiform caudicle; gland small.
Species 5.—Old World.
Of this genus which was not known before to be represented in the Bombay Pres., only the following species has been found in N. Kanara.

1. **Epipogum nutans** Reichb. f. in Bonpland. (1857) 36; Lindl. in Journ. Linn. Soc. i, 177; Benth. Fl. Austral. vi, 308; Hook. f. F.B.I. vi, 124; Trim. Fl. Ceyl. iv (1898) 222; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, t. 335; Fischer Fl. Madras pt. viii (1928) 1460; Brühl Orchid. Sikkim (1926) 148.—*E. roseum* Lindl. l. c.—*Galera nutans* Blume Bijdr. 415, t. 3; Mus. Bot. II, 187; Orchid. Archip. Ind. 139, t. 52 *et* 54E.—*G. rosea* Blume Mus. Bot. ii, 188; Orchid. Archip. Ind. 139.—*Podanthera pallida* Wight Ic. t. 1795.—*Ceratopsis rosea* Lindl. Gen. & Sp. Orchid. 383.—*Limodorum roseum* Don Prodr. Fl. Nep. 30.
Description : Tuber underground, 5 cm. and more in length; stem 10-40 cm. high; about 1 cm. thick at the base, gradually thinner upwards, with a few bracts and ending in a 5-20 cm. long raceme; flowers drooping, minus the

ovary about 12 mm. long, white; sepals and petals lanceolate-linear, connivent; lip oblong, concave, without side lobes but with a short blunt point, with a few reddish brown spots; spur half as long as the lip, somewhat bulbous; stem and ovary pale ochre-coloured.

Locality: N. Kanara: Yellapur, 1,800 ft. (Bell 4068 !).

Flowers: June 1918.

Distribution: Tropical Himalaya, Nepal, Sikkim in hot valleys up to 4,000 ft., Khasia Mts. up to 6,000 ft., N. Kanara, Madras Pres.: Coorg, Bolampatti Hills at 4,500 ft., Anamalais, Pulneys at 5,000 ft., Wynaad, Ceylon, W. Africa, Java, Australia.

31. TROPIDIA Lindl. (not in Cke).

Terrestrial, glabrous, leafy herbs. Stem often branched, roots rigid. Leaves sessile, membranous, subplicate; petiole sheathing. Flowers small, in axillary and terminal sessile or peduncled spikes; bracts coriaceous, often imbricate, strongly nerved. Sepals connivent, lateral more or less connate, dorsal free. Petals as long, or shorter, broad or narrow. Lip superior, sessile at the base of the column, cymbiform or produced into an obtuse spur, undivided, acute or with a reflexed tip, disk with short or long intramarginal ridges on lamellae; column short or long; rostellum long, erect, at length 2-fid; stigma anticous; anther erect, acute or acuminate, cells contiguous; pollinia 2, clavate, 2-cleft, caudicle long or short, gland small. Capsule cylindric-oblong.

Species 12.—Indo-Malayan, Polynesian.

1. **Tropidia Bellii** *sp. nov.* Blatter & McCann.

[*Pertinens at sectionem Cnemidiæ refert Tropidiam angulosam Blume sed distinguitur foliis basi rotundatis vel in vaginam decurrentibus, minime cordatis bracteis haud dimidiam florum longitudinem attingentibus, sepalis lateralibus subobtusis sub apice mucronatis, petalis quam sepalum dorsale latioribus, basalibus columnæ appendicibus minimis obtusis.*]

Description: Terrestrial, glabrous. Stem about 30 cm. high. Leaves elliptic or broadly lanceolate acuminate, membranous, subplicate, 9-11-nerved, sheathing at base, up to 15 by 7 cm., base rounded or tapering into the sheath. Peduncle short, spike up to 5 cm. long, terminal, about 7-flowered. Bracts about 12 mm. long, linear-subulate, scarcely half as long as the flower. Sepals 3-5-nerved; lateral sepals connate, lanceolate, subobtuse, with a distinct mucro below the tip; dorsal sepal linear-lanceolate, free. Petals broader than dorsal sepal, ovate-lanceolate, 3-5-nerved; lip superior, sessile at base of column, produced into an obtuse spur, undivided, as long as the petals, obtuse, lateral nerves lamellate below middle; basal columnar appendages very small, obtuse. Anther erect, cells contiguous; pollinia 2, clavate; gland minute. Fruit not seen.

Locality: N. Kanara: Guddehalli, in evergreen forest, 1,500 ft., rainfall 150 in. (T. R. Bell 2992 ! type, Herb. St. X. C. 26562 !).

Flowers: Sept. 1917.

32. SPIRANTHES Rich. (Cke. ii, 707).

Terrestrial herbs; roots fibrous or tuberous; stems erect, leafy, or the flowering leafless. Leaves usually narrow. Flowers small, in erect, secund, often twisted, many-flowered spikes. Sepals subequal, free, the lateral gibbous at the base, and inserted obliquely on the ovary, more or less cohering with the similar petals in an erect hood. Lip erect, sessile or clawed, entire or 3-lobed, base concave, disk bearing calli or lamellae. Column short, terete, base often decurrent on the ovary; foot 0. Anther erect, 2-celled; pollinia 2, 2-partite. pendulous.

Species 180–200.—Cosmopolitan with the exception of the arctic and subarctic zones; chiefly in tropical America.

Cooke has 1 species: *S. australis* Lindl which has to be changed into *S. sinensis* Ames.

Spiranthes sinensis Ames Orchid. II (1908) 53.—*S. australis* Lindl. in Bot. Reg. x (1824) *sub* t. 823; Dalz. & Gibs. Bomb. Fl. 270; Wight Ic. t. 1724 (*media fig. et dextra tantum*); King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii (1898) t. 369; Hook. f. F.B.I. vi, 102; Cke. ii, 707.—*Neottia sinensis* Pers. Syn. ii, 511.

Description : Cke. ii, 707.
Distribution: Konkan, S.M. Country, N. Kanara, throughout India from the Punjab and W. Tibet to Upper Assam and southwards to Ceylon and Chittagong, up to 7,500 ft. in Sikkim and 7,000 ft. in the Nilgiris, Afghanistan, N. Asia, China, Java, Australia, N. Zealand.

33. ZEUXINE Lindl. (Cke. ii. 708).

Species about 35.—Tropical Africa and Asia.
Cooke mentions 2 species from the Bombay Pres. : *Z. sulcata* and *Z. longilabris*. We retain them but change the first name into *Z. strateumatica*.

1. Leaves linear, sessile ... ... 1. *Z strateumatica.*
2. Leaves ovate, petiolate ... ... 2. *Z. longilabris.*

1. **Zeuxine strateumatica** Schlechter in Fedde Repert. Beih i (1911) 77 ; Fischer Fl. Madras pt. viii (1928) 1456.—*Z. sulcata* Gen. & Sp. Orchid. (1840) 485 ; Griff. Ic. Pl. Asiat t. 349 ; Hook. f. F.B.I. VI, 106 (*excl. Z. membranacea* Lindl.) ; King Pantl. in Ann. Roy. Bot. Gard. Calc. viii (1898) 286, t. 381 ; Trim. Fl. Ceyl. iv, 215 ; Prain Beng. Pl. 1029 ; Duthie in Ann. Roy. Bot. Gard. Calc. ix, pt. 2, 168 ; Fl. Upp. Gang. Pl. iii, pt. ii, 219 ; Cke. II, 708 ; Haines Bot. Bih. & Or. 1161 ; Brühl Orchid. Sikkim 171.—*Z. bracteata* Wight Ic. v, pt. 1 (1852) 16, t. 1724 *bis*.—*Z. brevifolia* Wight Ic. l. c. t. 1725.—*Z. robusta* Wight Ic. t. 1726.—*Pterygodium sulcatum* Roxb. Fl. Ind. iii (1832) 452.
Description: Cke. ii, 708.
Locality: Sind (Stocks 411).—*Gujarat:* Swampy ground on bank of Ambika Nala, Waghai Dangs (T. R. Bell 5386 !).—*Deccan:* Pashan near Poona (Gammie !) ; Deccan hills (Herb. Econ. Bot. Poona !).—*S.M. Country:* Near the bank of a stream, Gokak Falls, Belgaum Dist. (Sedgwick 5449 !) ; Dharwar (Law).—*N. Kanara* (Law).
Distribution: Abundant in grassy places throughout the greater portion of India, ascending to about 5,000 ft. on the outer Himalayan ranges, Malay Peninsula, Afghanistan, Ceylon, China, Japan, Java, Philippines.

2. **Zeuxine longilabris** Benth. in Benth. & Hook. f. Gen. Pl. iii (1883) 600 ; Hook. f. F.B.I. vi, 107 ; Trim. Fl. Ceyl. IV, 216 ; Prain Beng. Pl. 1029 ; Cke. ii, 709 ; Fischer Fl. Madras pt. viii (1928) 1456.—*Monochilus longilabre* Lindl. Gen. & Sp. Orchid. (1840) 487 ; Dalz. & Gibs. Bombay Fl. 271.—*M. affine* Wight Ic. v, pt. 1 (1852) 16, t. 1728.
Description: Cke. ii, 709.—Flowers white or olive with lip white and column orange.—The specimen from N. Kanara mentioned below was found epiphytic.
Locality: Konkan (Law, Stocks).—*N. Kanara:* Anmod, on bole of big tree in dense jungle, 2,000 ft. (Sedgwick 3371 !) ; Anmod (Talbot 1644 !) ; Pala (Talbot 3530 !).
Distribution: Bengal, Assam, Konkan, N. Kanara, W. Ghats of Madras Pres. from the low country to 4,000 ft., High Wavy Mts., Ceylon.

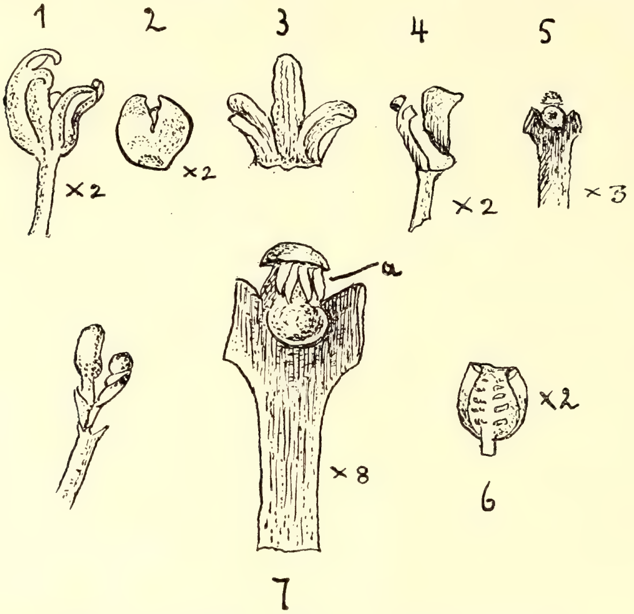
34. CHEIROSTYLIS GRIFF. (Cke. ii. 709).

Species 15.—Tropical Africa, Indo-Malaya, Australia.
Up to now 1 species was known from the Presidency ; we add a new one.

1. Lip with a spreading suborbicular deeply 2-lobed limb, lobes sub 5-fid ... ... 1. *C. flabellata.*
2. Lip with 2 large rounded somewhat incurved side lobes ; midlobe shorter ... ... 2. *C. kanarensis.*

1. **Cheirostylis flabellata** Wight Ic. v, pt. 1 (1852) 16 ; Dalz. & Gibs. Bomb Fl. 271 ; Hook. f. F.B.I. vi, 105 ; Trim. Fl. Ceyl. iv, 211 ; Cke. ii, 709 ; Fisher Fl. Madras pt. viii (1928) 1454.—*Monochilus flabellatum* Wight Ic. t. 1727.
Description: Cke. ii, 709.—The species of *Cheirostylis* are usually terrestrial. T. R. Bell has found an epiphytic specimen at Amboli.
Locality: W. Ghats : Tinai Ghat (Gammie (15816 !) ; Amboli Ghat (T. R. Bell !)).—S. M. Country : Chorla Ghat (Dalzell & Gibson).—*N. Kanara* : Kumpta-Sirsi road (Woodrow) ; Guddehalli (T. R. Bell 7842 !).

Distribution: Bhutan Himalaya, Tenasserim, Bombay Pres., Nilgiris and Pulneys at 6,000 ft. and upwards, Ceylon.



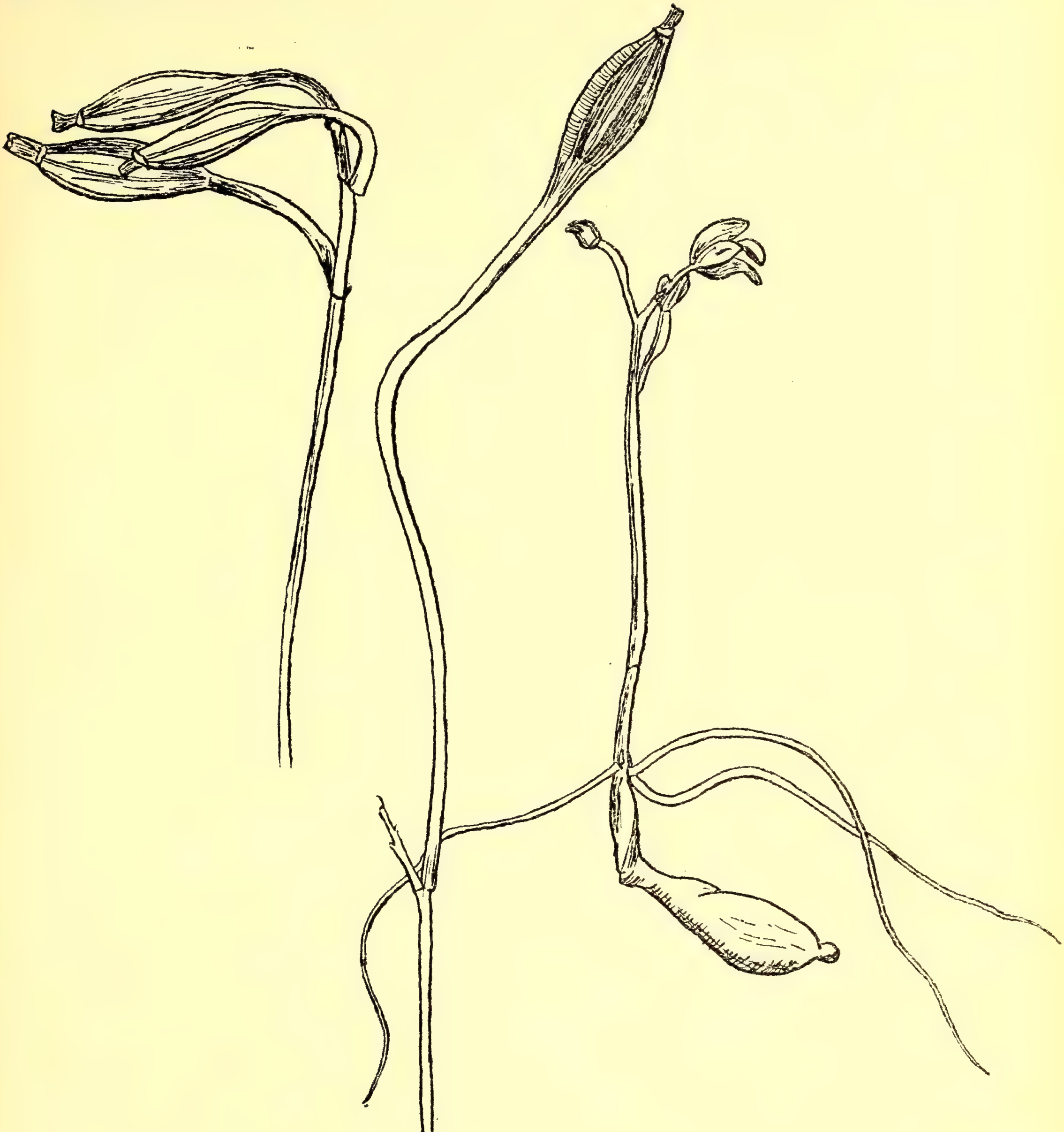
Cheirostylis kanarensis Blatter & McCann. *sp. nov.*

1. Flower; 2. Sepals subtending the lip; 3. Dorsal sepal and adnate petals; 4. Lip and Column; 5. Column; 6. Lip. 7*a* Attachment of pollinia hanging from underside of the raised caps, quite free.

2. **Cheirostylis kanarensis** *sp. nov.* Blatter & McCann.

Orchidacea similis Ch. flabellatae a qua differt scapo glabro, sepalis laterlibus fere semicircularibus, labio 3-lobato lobis lateralibus magnis.)

Description: A delicate saprophytic plant, only 5-7·5 cm. in height when flowering, extremely fragile, reaching 30 cm. in fruit. Root an irregular-shaped long tuber, lying horizontally about 7 cm. below the surface, 25 by 7 mm. to 7 by 3 mm., sometimes 1, sometimes more tubers to one plant; rootlets given off just below attachment of scape. Bract scarious. Flowers usually 3, racemose, at a right angle to the scape, 10 mm. long, 6 mm. wide between tips of petals when spread out, pure white, light brownish in bud. Pedicels up to 6 mm. long, often, reaching 15 cm. in fruit. Petals and sepals united into an involucre for column and lip, the division between the strongly hooded dorsal part, composed of dorsal sepal and petals and the lower part subtending the lip composed of the 2 sepals, is deepest reaching ⅔ of the ovary down, the division between the dorsal sepal and petals reaches ½ way down, that between the sepals about ⅓ of the way; all the divisions are acute. Dorsal sepal linear-oblong and minutely bifid, longest 9 by 2·5 mm.; petals 5 by 2 mm., similar but slightly falcate, entire. Lateral sepals 5 mm. long, nearly semicircular with the junction along the straight edges, edges slightly crenulate, all 3-veined, concave, the veins very prominent on the back, slightly saccate below like *Propax* to allow of the lip-hinges being curved. Lip 5 by 4 mm., with 2 large rounded side lobes, midlobe shorter, shortly rounded; side lobes somewhat incurved. Lip attached to a prolongation of the column by a very delicate curved hinge which allows it to assume the erect position it occupies facing and embracing the column, parallel to the dorsal sepal, with a central yellow, broad, furry ridge which is transversely very irregularly and deeply impressed, not pinnately divided, leaving central axis entire. The column is white,



Del. C. McCann after T. R. Bell.

Cheirostylis kanarensis Blatter and McCann, *sp. nov.*

slightly curved forwards and has 2 large square expansions (appendages, nearly parallel to each other, occupying the upper ⅓ or more, one on each side of the round stigmatic depression ; the dorsal part of the column produced very slightly beyond the level of those appendages into a rounded semicircular plate (rostellum) on the apex of which is fixed the cap by its edge, the cap being otherwise free, overhanging the stigmatic depression. To the underside of this cap are hung the 2 bipartite pollinia looking like sausages in a row, all in a line between the appendages of the column. Pollinia greyish, powdery looking, long-ovoid in shape. Ovary slightly twisted at base, 7 mm. long. Fruit large for the flower, being 20 by 4 mm., ovoid in shape but with 1 flattened face, the convex part of circumference having 2 of the 6 longitudinal somewhat predominant ridges (triangular in section), the flattened portion only 1 ; the apex bears the remains of the withered then cylindrical and brown flower, supported on a basal ring forming the truncated end of fruit. The capsule opens along the apex of the ridges and finally assumes, when completely open, a more or less globose shape, remaining joined at apex and base. The colour of the whole plant in fruit is light straw-yellow except the bracts and flowers which are dark brown. (After detailed sketches and MS. notes of T. R. Bell.)

Note : The tuber or tubers lie about 7 cm. underground in black soil under the shade of trees in jungle generally on the edge of a clearing. The rootlets arise just below the point of attachment of the stem and creep along close to the surface of the ground or on it under decaying leaves. The flowers are fertilized by a small very active hymenopter. The buds are very close together, nearly sessile, but as they get larger, the pedicels gradually lengthen until in flower they reach quite 6 mm. in length. This lengthening of the pedicels continues after flowering and the thickness also increases, until the fruit is ripe, sometimes reaching 15 cm. in length by 1½ times the thickness of the scape, pedicels of different lengths from 5–15 cm. being common on the same plant. The ordinary number of flowers to one plant is 3, but there may be as many as 5 buds, never more than 1 flower developing on any one day ; the bloom lasts only a day, expanding in the morning and every 24 hours a fresh flower is produced.

Locality : N. Kanara : Tatwal (T. R. Bell).
Flowers : June 1912.

35. PERISTYLUS Blume. (Cke. ii. 710).

Species about 80.—Warm regions of Old World.

Cooke has 5 species. We retain all and add 1 species, *P. stenostachyus*, not known from the Presidency before, and add a new species : *P. xanthochlorus*.

A. Leaves scattered or imbricate on the stem, not clustered
  I. Spur as long as the sepals or longer
    1. Stem stout ; Leaves many-nerved ; spike dense-flowered ; spur curved at base ... 1. *P. xanthochlorus.*
    2. Stem slender ; leaves 5-7-nerved ; spike lax-flowered ; spur straight ... ... 2. *P. stenostachyus.*
  II. Spur much shorter than the sepals, globose ... 3. *P. spiralis.*
B. Leaves clustered about the middle of the stem
  I. Lip longer than the sepals, obtusely 3-fid, lobes linear-oblong ... ... 4. *P. Stocksii.*
  II. Lip shorter than the sepals ; petals white 5. *P. plantagineus.*
  III. Lip as along as the sepals ; petals yellow or yellowish green
    1. Lateral sepals mucronate at the back below apex ; spikes dense, 10–30 cm. long ... 6. *P. goodyeroides.*
    3. Lateral sepals not mucronate at the back below apex ; spikes lax, 5–7·5 cm. long ... 7. *P. Lawii.*

1. **Peristylus xanthochlorus** *sp. nov.* Blatter & McCann.

Orchidacea similis Peristylo Richardiano Wight *necnon Peristylo stenostachyo* Krzl. *A priore differt scapo minore, foliis apiculatis et multinervosis, bracteis ovato-longe-acuminatis vel ovato-oblongis-acuminatis sepalis lateralibus linearibus falcatis subacutis vel obtusis, petalis ovato-oblongis aliquantulum* *obliquis, labii lobis lateralibus linearibus, in statu sicco tota planta brunnea minime nigrescente. A posteriore autem distinguitur scapo crasso, foliis multinervosis, bracteis multo largioribus floribus maioribus viridi-flavis nunquam albidis, spica cylindrica dens amulti—(usque 40–) flora, labii lobis lateralibus linearibus obtusis sursum curvatis et retrorsum, calcare ad basim curvato in tertia parte superiore paullum incrassato et ad apicem angustiore.*

Description: Tuber one. Stem 12-32 cm. high, stout, stiff, leafy, pale green. Leaves few (4-5), scattered on the stem, pale green or yellowish green, lanceolate or oblong-lanceolate, acute, apiculate, sheathing at base, many-nerved, recurved in the upper part, up to 6 by 2 cm., subplicate, succeeded by 1 or 2 bract-like leaves. Flowers greenish yellow, many (up to 40), subsecund or scattered, never secund, forming a dense terminal cylindrical spike 5–16 cm. long, usually as long as the flowerless part of the scape. Bracts not imbricating, the lower up to 15 by 4–5mm., shorter or longer than the flowers, ovate-long-acuminate, or ovate-oblong-acuminate, cucullate, upper 7 by 3 mm., midrib prominent on back. Lateral sepals linear, falcate, subacute or obtuse, pale green, 5 by 1·5 mm., obliquely ascending. Dorsal sepal pale green, oblong or narrowly ovate-oblong, obtuse, 5 by 2 mm., 3-nerved. Petals greenish yellow, membranous, ovate-oblong, slightly oblique, obtuse, 5 by 2 mm. Lip fleshy, rigid, 5 mm. long. 10 mm. broad, 3-lobed; basal claw very narrow and short with 2 rounded short auricles; side lobes 5 by 0·75 mm., linear, obtuse, spreading, curved upwards and backwards; midlobe 2·5–3 mm. long, narrowly triangular, obtuse, 1 mm. broad at base, narrower at apex. Ovary sessile, about 8 mm. long. Spur 6-7 mm. long, curved near the base, then appressed to ovary, slightly thickened in the upper third, getting thinner again at apex and obtuse, greenish white. Anther-tubes 0. Stigmatic processes large, elongating, parallel. Pollinia granular; caudicle very slender, as long as the pollinium. Gland very small. Rostellum short. Fruit 10 by 4 mm., sessile, flattened towards the axis, narrowly conical, rounded at base, 6-ridged, slightly twisted.

Locality: W. Ghats: Panchgani, 1st Tableland, in low grass (Blatter & Halberg B1686! type, Blatter P81!, Sedgwick 7566! 7596 bis! 7930!); Mahableshwar (Sedgwick 7622 bis! 7642!).

The Panchgani specimens are smaller throughout than those from Mahableshwar. Is it due to the much greater rainfall of the latter place, or to the scanty soil on the Tableland of Panchgani?

Flowers: September 1925 (Panchgani); October 1920 (Panchgani and Mahableshwar).

2. **Peristylus stenostachyus** Kraenzlin Orchid. Gen. & Sp. i, 502; Fischer Fl. Madras pt. viii (1928) 1474.—*Habenaria stenostachya* Benth. Fl. Hongk. 362; Hook. f. F.B.I. vi, 158.—*H. peristyloides* Wight Ic. t. 1702.—*Platanthera stenostachya* Lindl. in Hook. Journ. Bot. vii (1855) 37.

Description: Plant 10–50 cm. high, usually slender, with many small sheaths above the leaves. Leaves confined to the lower half or two-thirds of the stem, lanceolate or linear-lanceolate, obtuse, acute or acuminate, 2·5–10 cm. long, 3–17 mm. broad. Spike narrow, 2·5–15 cm. long, lax-flowered; flowers small, about 8 mm. diam., erect, greenish yellow or white; bracts 6-8 mm., broadly ovate-lanceolate, finely acuminate. Sepals 4 mm. long, subequal, concave, lateral linear, obtuse, suberect, at length spreading, nerve very thick, produced into a point under the apex of the sepal. Petals triangular-ovate or oblong, obtuse. Lip excavate at base, side lobes subulate, as long as or slightly longer than the sepals, spreading, longer than the broader, obtuse midlobe. Spur slender, straight, not thickened below. Anther minute, cells parallel, tubes 0. Pollinia short, grains large, caudicle and gland obscure. Stigmatic processes clavate; rostellum erect, truncate, dentate, plicate, concealing the glands of the pollinia. Ovary 6 mm. long.

Locality: W. Ghats: Castle Rock, on open rocky ground on the hill side 1,600 ft. (Sedgwick 2779!).—*N. Kanara:* In forests (T. R. Bell 5409!); Mundgod Road, rice fields (Talbot!); Tinai (Talbot 2508!); Yellapur, in abandoned rice fields (Talbot!).

Flowers: August 1917 (Castle Rock); August 1881 (Yellapur); September 1881 (Mundgod Rd.); September 1891 (Tinai).

Distribution: Sikkim Himalaya, Khasia Hills, Tenasserim, N. Kanara, Bababudan and Pulney Hills, High Wavy Mountains.

3. **Peristylus spiralis** A. Rich. in Ann. Sc. Nat. sér. 2, xv, 69, t. 2, B; Wight Ic. t. 1696; Kraenzlin Orchid. Gen. & Sp. i (1898) 510; Cke. ii, 711; Fischer Fl. Madras pt. viii (1928) 1474.—*Habenaria torta* Hook. f. F.B.I. vi. (1890) 159; Trim. Fl. Ceyl. iv, 234.
Description: Cke. 1. c.
Locality: Bombay Pres. (Dalzell 14! in Herb. Calc.).—*Konkan* (Law, Stocks).—*W. Ghats:* Tinai Ghat (Talbot 2508!).
Distribution: Bombay Pres., Bababudan and Nilgiri Hills, 5,000-7,500 ft., Travancore, Ceylon.

4. **Peristylus Stocksii** Kraenzlin Orchid. Gen. & Sp. i (1898) 513; Cke. ii, 710; Fischer Fl. Madras pt. viii (1928) 1475.—*Habenaria Stocksii* Hook. f. F.B.I. vi. (1890) 158.
Description: Cke. l. c.
Locality: Konkan: Mulland, in dense forest (McCann!); Dronaghiri (Stocks); Neral (Bhiva!); Ambenali (Blatter & McCann!).—*W. Ghats:* Fitzgerald Ghat, 2 miles from Mahableshwar (McCann 3942!).—*S. M. Country:* Ramghat (Ritchie 1398).—*N. Kanara:* Sirsi, in evergreen forest (Sedgwick & Bell 7004!).
Flowers: July to August (ex Cooke).
Flowers and Fruit: October 1919 and 1930.
Distribution: Bombay Pres., Mysore.

5. **Peristylus plantagineus.** Lindl. Gen. & Sp. Orchid. (1835) 300; Wight Ic. t. 921; Kraenzlin Orchid. Gen. & Sp. i (1898) 516; Cke. ii, 711; Fischer Fl. Madras pt. viii. (1928) 1475.—*Peristylus elathus* Dalz. & Gibs. in Kew Journ. Bot. iii (1851) 344; Bomb. Fl. 270.—*Habenaria Wightii* Trim. Cat. Ceyl. Pl. (1885) 91; Hook. f. F.B.I. vi. (1890) 162; Trim. Fl. Ceyl. iv, 232.
Description: Cke ii, 711.
Locality: Konkan: (Nimmo!); Malvan (Dalzell).—*W. Ghats:* Near Lonavla (Kanitkar! Herb. Econ. Bot. Poona); Ramghat (Ritchie 1396); Londa (Spooner!).—*S. M. Country:* Devikot, Dharwar Dist., deciduous forests, 2,000 ft. (Sedgwick 3007!).—*N. Kanara:* Karwar (Talbot!); maritime scrubs on rocks by the sea (Sedgwick & Bell 6783!); Guddehalli (Talbot 443!); on edges of open spaces in jungle (T. R. Bell 7869 bis!), in forests (T. R. Bell 5410!); forests of Nayayali, 2,000 ft., rainfall 80 in. (Sedgwick 2945!); Yellapur, common in places (Talbot 551!).
Flowers: August 1881 (Yellapur); August 1889 (Karwar); August 1883 and 1920 (Guddehalli); September 1883 (Yellapur); September 1919 (Dharwar Dist.); October 1882 (Yellapur).
Fruit: September 1917 (Nayayali)! October 1919 (Karwar).
Distribution: Central Provinces (Pachmari); Bombay Pres., Madras Pres.; Rampa Hills, Anamalais, 2,000-2,300 ft., Travancore, Malabar, Ceylon.

6. **Peristylus goodyeroides** Lindl. Gen. & Sp. Orchid. (1835) 299; Dalz. & Gibs. Bomb. Fl. 270; Royle Ill. t. 87, f. 2; Cke. II, 712; Fischer Fl. Madras pt. viii (1928) 1475.—*Habenaria goodyeroides* Don Prodr. 25; Hook f. F.B.I. vi, 161; King & Pantl. Ann. Roy. Bot. Gard. viii, t. 430.
Description: Cke. 1. c.
Locality: Konkan (Nimmo, Dalzell).—*W. Ghats:* Castle Rock, 1,600 ft. (Sedgwick 2806!).—*N. Kanara:* Devimane Ghat (Sedgwick & Bell 6942!).
In bud: August 1917 (Castle Rock).
Distribution: Nepal, Sikkim, Khasia Hills, Naga Hills, Konkan, N. Kanara, W. Ghats of Bombay and Madras Pres., 2,000-4,000 ft.

7. **Peristylus Lawii** Wight Ic. v, pt. 1 (1852) 12, t. 1695; Dalz. & Gibs. Bomb. Fl. 270; Kraenzl. Orchid. Gen. & Sp. i (1898) 510; Cke. II, 712.—*Habenaria Lawii* Hook. f. F.B.I. vi (1890) 162; Prain Beng. Pl. 1032; Duthie in Ann. Roy. Bot. Gard. Calc. ix, pt. 2, 192, t. 143; Fl. Upp. Gang. Pl. iii, pt. ii. (1920) 227.
Description: Cke. ii, 712.
Locality: Konkan: (Dalzell, Law); Neral (Bhiva!).—*W. Ghats* (Gibson! Herb. Calc.).—*S. M. Country:* Belgaum (Law); near Dharwar (Law ex Stocks 73).
Distribution: W. Himalaya, in Garhwal, Bengal, Bihar, C. Provinces, in the Chanda Dist., Bombay Pres.

36. PLATANTHERA Rich. (Cke. ii. 712).

Species about 80.—Throughout the N. temperate regions and in the tropics of Asia and Africa, chiefly in the mountains.

1. **Platanthera Susannæ** Lindl. Gen. & Sp. Orchid. (1835) 295; Dalz. & Gibs. Bomb. Fl. 269; Wight Ic. t. 920; Kraenzl. Orchid. Gen. & Sp. i (1898) 601; Cke. ii, 713; Fischer Fl. Madras pt. viii (1928) 1475.—*Habenaria Susannæ* R. Br. Prodr. (1810) 312; Hook. f. F.B.I. vi (1890) 137; Prain Beng. Pl. 1030; Haines Bot. Bih. & Or. 1155; Duthie in Ann. Roy. Bot. Gard. ix, pt. 2, 178, 128.—*Orchis Susannæ* Linn. Sp. Pl. (1753) 939.—*Orchis gigantea* Don Prodr. 24.—*Platanthera robusta* Lindl. in Wall. Cat. no. 7036.

Description: Cke 1. c.

Locality: Konkan: Matheran (Cooke!).—*W. Ghats:* Khandala (Stocks 7, Blatter!, Hallberg!, Cooke!); Panchgani, above Khingar (McCann!); Mahableshwar (Cooke, Blatter & McCann!, McCann!); Castle Rock (Sedgwick 4482!, Gammie 15784!).—*S. M. Country:* Belgaum (Ritchie 1395).—*N. Kanara:* Yellapur (Talbot 732; Herb. Calc., T. R. Bell 3121!).

Distribution: Outer Himalayan range in Garhwal and Kumaon up to 6,000 ft., Sikkim, Khasia, Naga and Manipur Hills, Burma, Chota Nagpur, Konkan, S. M. Country, N. Kanara, W. Ghats of Bombay and Madras Pres., 1,600-7,500 ft., China, Malay Archipelago.

(*To be continued.*)

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS. (ORNITHOLOGICAL SECTION).

BY

HUGH WHISTLER, M.B.O.U., ASSISTED BY N. B. KINNEAR, M.B.O.U.

PART—II.

(*Continued from page 524 of this volume.*)

orientalis

Turdoides somervillei malabaricus (Jerdon).

Specimens collected :—10 ♀ 10–4–29, 25 ♂ 11–4–29, 35 ♂ 12–4–29, 56 ♀ 15–4–29, 130, 135 ♂♂ 26–4–29 Kurumbapatti ; 246 ♂ 18–5–29, 270–271 23–5–29 Shevaroy Hills, 4,000 ft. ; 334 ♂ 5-6-29, 343 ♂ 6-6-29, 352 ♀ 7-6-29, 369 ♂ 9-6-29, 381 ♂ 11-6-29, 399 0? juv. 13-6-29, 406 ♂ juv. 14-6-29 Chitteri range 2,000-3,000 ft. ; 572 ♀ 21-7-29 Gingee ; 668 ♂ juv. 8-8-29, 681 ♀ 12-8-29, 720 ♂ 20-8-29, 737 ♂ 23-8-29, 738 ♂ juv. 29-8-29 Palkonda Hills, 1,000 ft. ; 772-3 ♂ ♀ 30-8-29, 823 ♂ 17-9-29 Koduru ; 881 ♂ 5-10-29 Seschachalam Hills, 2,000 ft. ; 1,001-2 ♂ ♀ 11-11-29 Nallamalai Hills, 2,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
17 ♂	21–24·5	101–107	100–109	33-36·5 mm.
3 ♂ juv.	21–23	95-99	99–104	33–33·3 ,,
7 ♀	20·5-23	94–106	93–104	33·5–35·5 mm.
1 ♀ juv.	22·5	94	88	33 mm.

This is the ordinary race of the Jungle Babbler throughout the greater part of the Madras Presidency. The Survey met with it throughout the various ranges from the Krishna River (Nallamalais, Seschachalam Hills, Palkonda Hills, Shevaroys and Chettiri range) southwards to the Salem District. It occurs up to a height of 4,000 ft., and also apparently in the neighbouring plains, as a shy bird of the better afforested areas. It does not mix with the White-headed Babbler. There is no information as to whether it occurs southwards from Salem to the extremity of the Peninsula, but from the fact that it is common round the base of the Palni Hills and at the foot of the South Travancore Hills we expect that it does so. In the Palnis it occurs up to 4,500 ft. and Ferguson obtained a single bird at 4,000 ft. on the High Range in the North of Travancore but curiously enough it is not recorded from the Nelliampathis. All over the Nilgiris and the Wynaad it is common. There is no record from Coorg but it occurs in Malabar.

Turdoides somervillei terricolor (Blyth).

Specimens collected :—1,354 ♂ 8–2–30, 1,399 ♀ 17–2–30 Anantagiri, 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
♂	24·5	102·5	95·5	34 mm.
♀	23	96·5	Moult.	33·5 mm.

In the Madras Presidency this race of the common Jungle Babbler is confined to the north-east and even there it is by no means generally distributed.

Jerdon states that it occurs at Gumsoor (B. of I, ii, 59). The above two specimens were procured by La Personne in a silk cotton tree at Anantagiri and he remarks that while it was nowhere common in the Vizagapatam District it was not observed at all at Sankrametta.

Specimens collected by Blanford at Rajamundri, Ellore and Dumagudiam are in the British Museum.

We have seen no evidence for the oft-repeated statement that the Jungle Babbler is double-brooded. All races throughout India appear to breed chiefly during the monsoon rains in June and July though many nests will be found from March to August and odd ones are recorded in the winter months. There may therefore easily be 6 months difference in the age of young birds, hatched in the same generation, which is sufficient to account for the supposed two broods and the apparent coincidence of the moult with the breeding season. Both sexes share in incubation.

In identifying the survey series we have spent a great deal of time studying the difficult question of the races of the Jungle Babbler and in consequence would divide them as follows.

Turdoides somervillei sindianus (Ticehurst).

Crateropus terricolor sindianus Ticehurst, Bull. B.O.C. xl, 1920 (June), p. 156—Karachi, Sindh.

N. W. India. The northern boundary is the Himalayan foothills from the Jumna valley to near Rawalpindi, and the Salt Range. The western boundary lies along the base of the frontier hills from Kohat District to Karachi. The southern boundary is ill defined from lack of specimens but this form occurs at Delhi and Mount Aboo. In N. Rajputana it is rare and it is absent from the deserts of Central and Western Rajputana. Not known to occur in Cutch.

Turdoides somervillei terricolor (Blyth).

Malacocercus terricolor Blyth, J.A.S.B., 1844 (after 17th Dec.), p. 367—Nepal.

N.-E. India. The northern boundary is the Himalayan foothills from the Jumna valley to Assam as far east as Dibrughar. The western boundary is a line drawn roughly through Meerut, Agra, Saugar and S. E. Berar. The eastern and southern boundary is formed by the Brahmaputra River and the coast from the Ganges delta to the Godavary delta.

Turdoides somervillei malabaricus (Jerdon).

Malacocircus malabaricus Jerdon, Ill. Ind. Ornith., text to pl. 19, 1845 (March)—Malabar.

The rest of India, excluding the range of *T. s. somervillei* and the mountains of Southern Travancore.

(NOTE.—All along the junction of the ranges of *sindianus*, *terricolor* and *malabaricus* there is a good deal of intergrading so that individuals cannot be satisfactorily assigned to either race).

Turdoides somervillei somervillei Sykes.

Timalia somervillei Sykes, P.Z.S., 1832 (July 31), p. 88—Bombay ghats.

Confined to a narrow strip of the western coast from about Bombay and Matheran down to the southern part of the Kumta taluka of N. Kanara. In these limits it is found both on the coastal plain and the Sahyadri range above at all heights, but not on the plateau beyond.

The fact that *somervillei* is not a separate species but merely one of the races of the Jungle Babbler has hitherto been obscured by faulty definitions of its distribution. The statement in the *New Fauna* that it occurs from Travancore to Bombay along the west coast is apparently based only on wrong identification of the ferruginous stained specimens of *Turdoides s. polioplocamus*, obtained at Kolachal. In Kanara District it is true that both *somervillei* and *malabaricus* do occur, but whereas the former is confined to the coastal strip down to the southern part of the Kumta taluka and through the Supapetta, the latter bird is confined to the forests above the ghats and does not descend below them (James Davidson, J.B.N.H.S., xi, 655). As *somervillei* is the oldest name it will stand for the species.

At first sight it appears curious that there is no definitive representative of this species in Ceylon. The explanation is that *Turdoides striatus striatus* there really represents both the Jungle and White-headed Babblers and is, strictly speaking, a connecting link between them.

Turdoides striatus polioplocamus Oberholser.

Turdoides striatus polioplocamus Oberholser, Proc. Biol. Soc., Washington, xxxiii, 1920 (Dec.), p. 84—Gingee [= *Crateropus griseus*, Fauna, ed. i.]

Specimens collected :—3 ♀ 9-4-29, 24 ♂ 11-4-29, 34 ♂ 12-4-29, 90 ♂ 19-4-29, 93 ♂, 97 ♀ 20-4-29, 110 ♀ 22-4-29, 131–134 ♂ ♀ ♂ ♂ 26-4-29 Kurumbapatti ; 307 ♂

2-6-29, 345 ♂ 6-6-29, 353 ♂ 7-6-29, 356 ♀ 7-6-29 Chitteri range 2,000 ft. ; 457 ♀ 21-6-29 Tirthmalai 1,000 ft.; 560 O ? 19-7-29 Gingee; 756 ♀ 26-8-29 Palkonda Hills 500′ ; 846 ♀ 28-9-29, 900 ♀ 10-10-29, 903 ♂ 11-10-29, Seschachalam Hills 2,000′ ; 954 ♀ 1-11-29, Nallamalai range 2,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
11 ♂	20–22	94·5–109	95–107	32·5–35 mm.
11 ♀	19–21·5	101·5–108	95–106	30·5–35 ,,

In first year birds the wing and tail measurements are shorter as a rule than in adults, but they are included in the above.

This Babbler has a markedly southern distribution in the Peninsula of India but it is by no means generally distributed. It is the common Babbler of the Madras Presidency and most of its range falls within our limits. On the eastern side, its northern boundary appears to be the Godavery valley where Blanford obtained it 60 miles north of Ellore and as far up as Dumagudiam ; whilst D'Abreu found it still higher at Kotari, south of Chanda. Jerdon's statement that it occurs up to the N. Circars (B. of I, ii, 60) does not include that area itself where elsewhere (Madras Jour. Lit. Sci., 1839, p. 258) he stated he had never seen it.

It is not uncommon at Secunderabad. From here it occurs all down the line of the Eastern ghats (the Nallamalais, Seschachalam, Palkonda, Chettiri Hills) and throughout the Carnatic as far as Salem District. How far it is found south of Salem is unknown to us, but Captain Bates states that it does not occur at all at Trichinopoly. It is, however, common in the extreme south of Travancore about Cape Comorin, extending up the low lying country as far as Anjango.

It is entirely absent from the hill ranges of Travancore and Cochin, the Palnis, the Nilgiris, the Wynaad and Coorg. Although also absent or scarce, so far as is known, in the greater part of Mysore we have seen a specimen from Sivasamodrum (Wardlaw-Ramsay) and it is common round the south-west border as between Muddur and Gandalupet (Davison) and Manzeerabad (Macgregor). From here and Mangalore it extends up the west coast to the Gaprabha River which, on this side, forms its boundary.

There has been a good deal of confusion as to the relationship of the Ceylon Babbler (*Turdoides striatus striatus*) with the two Indian species the Jungle Babbler (*T. somervillei*) and the White-headed Babbler and this has led to statements that the Ceylon bird occurs in Travancore and the Nilgiris.

Now the White-headed Babbler is to be distinguished from the Jungle Babbler by (1) the uniform pale, almost creamy white crown and nape, contrasting with the darker ear-coverts, (2) the smaller and shorter bill, (3) the dark colour and squamation of the chin, throat and breast. In the White-headed Babbler the feathers of these parts are very dark with pale circular fringes, whereas in the Jungle Babbler these feathers are paler with darker streaks down their edges, the differences being most marked on the breast, (4) the richer buff of the abdomen, (5) the pale central streaks on the breast are usually narrower, (6) the general colour of the body plumage is brown as opposed to grey.

In many specimens of the White-headed Babbler, however, the ' White-head ' is not very distinct, either from immaturity or wear. In some specimens, indeed, it is hardly paler than in the Jungle Babbler. Such specimens agree closely with the Cinghalese bird as do often immature Jungle Babblers, and to such birds are due the supposed occurrences of *T. s. striatus* in India. The older writers evidently considered *T. s. striatus* as a form of *terricolor* but we entirely agree with Harington and Stuart-Baker in treating it as conspecific with the White-headed Babbler. In our opinion the dark squamated breast is far more important than the pale head as a specific character, whilst intermediates are found in Hume's specimens from Rameswaram Island. These latter are always recorded as *T. s. striatus* but we consider them intermediate in character and definitely closer to the Indian race of the two.

No importance attaches to the ferruginous staining of the specimens in the B. M. from Kolachal, commented on by Hume in S. F., iv. 456. An albino from Madras is recorded in S. F., ix, 507 ; a specimen in the Society's collection from Vellore (J. S. Battie) is largely white, except for the chin, throat and tail.

There is no association in life between the White-headed and Jungle Babblers. Where their distribution coincides it will be found that the White-headed Babbler largely relies on the presence of man to support him against his stronger, more jungle-loving relative.

In this species, as in the last, the breeding season is poorly defined. Eggs may be found in any month but the majority are laid from March to July.

Argya caudata caudata (Dumont).

Cossyphus caudatus Dumont, Dict. Sci. Nat., xxix (1823, December 27), p. 268—India.

Specimen collected :—456. ♀ 21-6-29 Tirthamalai 1,000 ft.

Measurements—

Bill.	Wing.	Tail.	Tarsus.
20	75·5	101	28 mm.

This was apparently the only specimen of the Common Babbler met by the Survey, and the species is clearly far less generally distributed that the sweeping distribution given in the *New Fauna* would lead one to believe.

For the Presidency we can only trace the following records. A specimen obtained by Blanford near Ellore is in the British Museum and a pair from S. Arcot district are in the Indian Museum. Fairbank found it plentiful at the base of the Palni Hills. Although not found in Ceylon it occurs on Rameswaram Island.

In the west of the Presidency it has only been recorded in Coorg (see Betts, J.B.N.H.S., xxxiii, p. 543 who calls it uncommon there, but this record is evidently erroneous and due to confusion with *Argya subrufa*) and at the base of the Coonoor ghat where Hume saw three near the railway station (S. F., vol. x. p. 383).

It is noteworthy that although *Argya caudata* has two subspecies *eclipes* (Trans-Salt Range Plateau) and *huttoni* (Afghanistan, Baluchistan) in those areas where *Argya malcolmi* does not occur, it agrees with that bird in having developed no races in its very wide distribution in India proper.

Argya subrufa (Jerdon).

Timalia subrufa Jerdon, Madras Jour. Lit. Sci. x, 1839 (after October), p. 259—Manantoddy, Wynaad.

Not obtained by the Survey. The distribution given in the *Fauna* is wrong. The Rufous Babbler is found along the Western ghats from Talmet near Mahableshwar (Fairbank) down to Malabar, the Wynaad, Coorg and the Nilgiris, being rare to the north and commoner southwards. It does not ascend to the plateau of the Nilgiris. It is also fairly common throughout the Travancore Hills, though Kinloch does not record it in the Nelliampathis and its occurrence in the Palnis rests on a female in the Indian Museum obtained by W. Daly. Its easterly limits are not very clear but a specimen marked 'Mysore' in the Hume collection and one marked 'Shevaroys' (W. Daly) in the Indian Museum catalogue suggest that it extends further east than is usually recognised.

The breeding season is given in the *Fauna* as February and March but, although Ferguson obtained a fully fledged young bird at Ponmudi, Travancore, in April (J.B.N.H.S., 202) Davidson in N. Kanara obtained their nests in April and May and also during the rains (J.B.N.H.S., xi., 655).

Argya malcolmi (Sykes).

Timalia malcolmi Sykes, P.Z.S., 1832 (July 31), p. 88—Deccan [=Poona].

Specimens collected :—446 ♂ 449 ♀ 19-6-29 Harur 1,000 ft. ; 1069 ♀ 9-12-29 1088-9 ♂ ♂ 11-12-29, 1091 O ? 12-12-29, Cumbum Valley.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	21·5–23	115–20	129–140	35–36·5 mm.
2 ♀	22–23	110·5–118	128	35–36 mm.

The Large Grey Babbler has a somewhat limited distribution in the Presidency where it largely avoids the Eastern ghats, though Roscoe Allen found it breeding at Horsleykonda (J.B.N.H.S., xviii, p. 906). The Survey obtained four specimens in the Cumbum Valley, Kurnool. Jerdon met with it at

Nellore and on the slopes of the Shevaroys. At Harur and Tirthamalai La Personne reports that it was common, though he did not meet with it in other parts of the Salem district.

Further west it is found in the Nilgiris though there also it is local and not common. William Davison and Miss Cockburn found it on the lower slopes below Kotagherry and the former knew of an isolated flock as high as Ootacamund. Terry's record of meeting it once on the lower slopes of the Palnis near Palni village (S.F., x. p. 475) remains the most southerly record.

It is not known to occur on the Western ghats or their seaboard. With this exception, the bird is found northwards over the whole Peninsula to a western boundary through Kathiawar and Rajputana (with possibly an isolated colony in Sindh at Sehwan *vide* Ibis. 1922, p. 541) to the Sutlej at Ferozepore and Ludhiana. The eastern boundary runs from Kurnool through Chanda to Allahabad, but Stuart Baker remarks (*New Fauna* I, p. 201) that he has received it from Sirguja. This suggests that it is extending its range as Ball had no record of it from Chota Nagpur. The northern boundary between Ludhiana and Allahabad runs along the limit of the plains. In the whole of this wide range it is most common and generally spread on the tablelands of the Deccan. Otherwise it is but locally common, scarce in some localities and missing from others equally suitable. This fact combined with the absence of any races suggests that its present distribution is the result of a rapid spread in comparatively recent times with the increase of cultivation.

The breeding season appears to be the same througout India, from March to November though the majority of eggs are apparently laid in the rains in June and July. As with other Babblers, however, the season is poorly defined and nests may be found in any month.

Pomatorhinus horsfieldii horsfieldii (Sykes).

Pomatorhinus horsfieldii Sykes, P. Z. S., 1832 (July 31), p. 89,—'Dense woods of the Ghats' [=Mahableshwar].

Specimens Collected :—122 ♂ 24-4-29, 140-142 ♂ ♂ ♀ 27-4-29 Kurumbapatti; 214 ♂ 218 ♂ 13 5-29, 242 ♀ 17-5-29 Shevaroy Hills 3,500-4,500 ft.; 639-641 ♀ ♂ ♂ 2-8-29, 669 ♂ 9-8-29, 688 14-8-29 Palkonda Hills 500-1,000 ft.; 991 ♀ 9-11-29 Nallamallai range 2,000 ft., S. Kurnool; 1371-2 ♂ ♀ 11-2-30, 1392-3 ♀ ♂ 16-2-30, 1760 ♀ 3-5-30 Anantagiri 3,000 ft; 1478 ♀ 5-3-30, 1544 ♂ 15-3-30, 1603 ♀ 26-3-30 Sankrametta 3000-3500 ft.

Measurements—

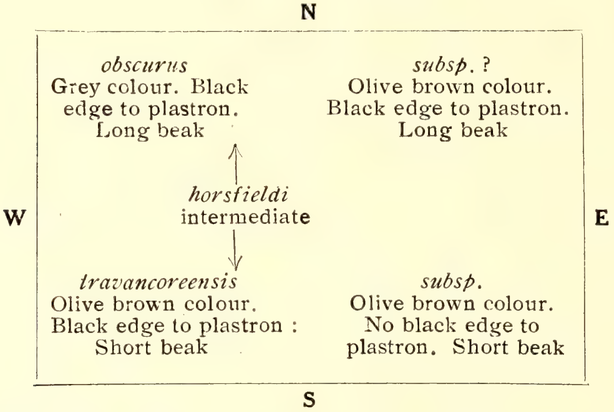
	Bill	Wing	Tail	Tarsus
11 ♂	29-33	89-100·5	94-103	31-35 mm.
10 ♀	30-33·5	90-98	91·5-98·5	30·5-34 ,,

The presence of the Southern Scimitar-Babbler in the Eastern ghats and Orissa has been ignored by the *New Fauna* though the fact was long ago recorded by Jerdon, confirmed by other writers and duly chronicled in the *Old Fauna*. It is as a matter of fact very common and widely spread on the Eastern side of the Presidency.

In the Vizagapatam ghats, La Personne reports that the birds were fairly generally distributed. In early March their organs were slightly enlarged. They fed a great deal on the ground, he says, turning dead leaves over or probing between the thick moss and the bark on trees, and they were also frequent visitors to the flowers of the cotton tree. One was seen to stick its bill into the ground and worry what appeared to be the hole of a trap door spider.

In Cuddapah district they were very common at Ballepalle in August and then had apparently finished breeding, young being on the wing. A bird labelled S. Arcot is in the Indian Museum. In Salem District, according to La Personne, this species was common practically everywhere both in jungle on the plains and up to the highest points of the Shevaroys and Chettiri range. There in May and June the birds were in pairs and their incessant calls could be heard all day long. In the West of the Presidency another race occurs.

We are by no means satisfied that the above series of specimens represents one form. The birds from the Vizagapatam area appear to have a more clearly defined black edge to the white plastron and also larger beaks 31-33·5 mm., as compared with 29-31·5 mm. in the other specimens from south of the Godavery. The correct treatment of the races of this species is a matter of some difficulty. There is no difficulty in recognising a large pale race with a long beak, *P. h. obscurus*, in the north-west of its range, or a richly coloured race, *P. h. travancoreensis*, in the south-west of its range. The bright ferruginous race *P. h. melanurus* of Ceylon is also very distinct.[1] But between *obscurus* and *travancoreensis* there is complete intergradation through the whole of the Western ghats. Unfortunately, the typical race is nothing more or less than the intermediate between these two forms. The historical accident that Sykes paid a visit to Mahableshwar prior to 1832 has been crystallised by the law of priority and really prevents a scientific treatment of this group. The situation often occurs but it is particularly glaring in the case of the Southern Scimitar-Babbler. It is easily illustrated by the following diagram which we make as a result of our examination of a large number of specimens from all parts of the bird's range. The square represents the Peninsula range of the bird, exclusive of Ceylon, set in terms of the compass.


N
obscurus
Grey colour. Black edge to plastron. Long beak
subsp. ?
Olive brown colour. Black edge to plastron. Long beak
W
horsfieldi
intermediate
E
travancoreensis
Olive brown colour. Black edge to plastron : Short beak
subsp.
Olive brown colour. No black edge to plastron. Short beak
S

If we had only to deal with the birds at the four corners there would be no difficulty. As with *Dendrocitta vagabunda*, we should recognise 4 races grading into one another, not quite such good races as in *vagabunda* as the range is not so extensive, but still recognisable. But with the present species the typical form is an unstable intermediate whose distribution cannot be satisfactorily defined. The result is that apart from Mt. Aboo and the Satpuras on the north-west and the Nilgiris and Travancore ranges on the south-west we cannot satisfactorily define the ranges or identity of any of the western specimens, while on the east we cannot define either the northern or the southern group in terms of the typical race, distinct though they are from each other and from *obscurus* and *travancoreensis*. We shrink from naming two more races. It will not be satisfactory to recognise 5 races when 50 per cent of specimens cannot be assigned without hesitation to any of them. It is not on the other hand satisfactory to recognise three races in the west and none on the east, combining the two eastern forms with the typical race of the central west. It is hardly satisfactory to combine one of the eastern races arbitrarily with the typical form and to name the other. The situation is one which will often occur in the study of subspecies under the present rules of priority of nomenclature and will need eventually to be legislated for if nomenclature is not to hamper science.

For the present therefore we leave our specimens under the typical race in the faint hope that a difficult situation may be explained by further material obtained by the Hyderabad Survey.

The juvenile plumage of this Scimitar Babbler is most interesting. Specimens of both *P. h. horsfieldii* and *P. h. obscurus* are in the British Museum. That of the typical race differs from the adult as follows :—Crown uniform dark olive brown without the black lateral streaks ; upper plumage more golden olive brown, especially on the wings and coverts ; white feathers of the lower throat with faint black tips ; black edging to plastron replaced by bright ferruginous and the remainder of the lower plumage washed and mottled with rufous. The juvenile of *obscurus* from Mt. Aboo is similar, but reflects the difference of tint in the two races. It will be appreciated, therefore, that the juvenile plumage of Peninsula birds approximates in colour to the adult of the Cinghalese race.

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[1] We cannot agree with the suggestion that there are two races in Ceylon.

Pomatorhinus horsfieldii travancoreensis Harington.

Pomatorhinus horsfieldi travancoreensis Harington, J. B. N. H. S., xxiii 1914 (Nov. 20), p. 333—Peermall [misprint for Peermade], Travancore.

Although its distribution lies out of the path of the Survey, this form of the Southern Scimitar Babbler is one of the commonest and most widely distributed birds of the Presidency. A specimen from the ' Malabar Coast ' is in the British Museum. In Coorg, the Brahmagiris, many parts of the Wynaad, the Nilgiris, the Nelliampathis and Palnis and the hills of Travancore it is common and generally distributed at all elevations. A specimen from the High Wavy Mountains (Madura) is in the Society's collection. An albinistic specimen obtained at the Kalhatty Sigur ghat (Nilgiris) 5,500 ft. on 29th June was recorded by Col. H. R. Baker (S. B. N. H. S., xxviii, 1135).

In this area the breeding season appears to be from January until May.

Dumetia hyperythra hyperythra (Franklin).

Timalia hyperythra, Franklin, P Z. S., 1831 (October 25), p. 118—Between Calcutta and Benares and in the Vindhyan Hills between the latter place and Gurra Mundela.

Specimens collected:—1525 ♀ 12-3-30, 1538-9. ♀♂ 14-3-30, 1592 ♀ 24-3-30, 1653♂ **3** 4-30, 1654♀ 4-4-30 Sankrametta 3,000 ft.-3,500 ft.

Measurements.—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	14	55·5	62-64·5	18·5–19 mm.
4 ♀	13–14	52·5–55	58-63	18·5–19·5 ,,

The Survey met with the typical race only in the Vizagapatam District where a series were collected at Sankrametta from 2,000ft. to 3,500ft, and others were observed in the Padwa Valley.

With the exception of Blanford's specimens in the British Museum, obtained 50 miles from Ellore (♀ 11-2-71) and near Rajamundri (♀ 3-4-71) these form the only records for the Presidency.

The Survey has afforded us an opportunity of clearing up the position with regard to the Rufous and White-throated Babblers. These two birds have hitherto been treated as separate species, on the ground that their distributions overlap. We have collated all the published records and examined as many specimens as possible, and have in consequence satisfied ourselves that there is no overlapping of ranges. Certain errors in the early records have been quoted from writer to writer and so obscured the real position.

The typical race is confined to a large area in northern and central India. The most north-westerly locality from which it has been recorded is Koteghar near Simla. This record is based on a single skin in the Hume collection labelled ' Koteghur ' without other details to authenticate it and it may be accepted with some reserve, in view of our fairly extensive knowledge of this area. There are however three other skins in the Hume collection taken in 1868 and 1871 in the Kumaon Bhabar.

From the Kumaon Bhabar the species is common locally throughout the central and eastern United Provinces (Lucknow, Cawnpore, Mirzapore, Rae Bareli, Fatehpur and Allahabad (Gill. J.B.N. H. S., xxviii, 1073) to Chunar near Benares) where Brooks found it. There is no record of its being found in Behar and in view of Steven's later testimony we find great difficulty in accepting the authenticity of the skin said to have been collected by Brooks at Darjeeling on 26-5-79. Brooks himself does not refer to this specimen in his Darjeeling notes (S. F., viii). From here the boundary runs down through Orissa where Ball (S. F., vii. 213) records it at Maunbhum and Midnapore, as well as in other districts south of that line.

From Lucknow and Cawnpore the north-eastern limits of the typical race appear to run roughly through the line Jhansi, Sehore and Mhow to Seoni in the Satpuras, that is along the shore of the ancient Indian continent. From the Satpuras the boundary line runs roughly across to Hyderabad city and the valley of the Krishna, which at this point is clearly the southern limit of the typical race. Throughout its range the distribution is somewhat patchy but it occurs alike in the hills and plains.

The fact that the distribution of the Rufous Babbler is generally given as extending to the Konkan and Thana and Khandalla is due to early records quoted by Barnes (and in more detail by Hume) on the authority of Mr. Wenden. There is plenty of evidence, however, that *albogularis* is the form in these localities and even Jerdon himself did not at one time discriminate satisfactorily between the buff-throated and white-throated races.

The breeding season in this race is well defined throughout its range, being in the monsoon from June to August, the majority of eggs being laid in July.

The white-throated race *albogularis*, on the other hand is confined to a strip of country down western India and to the south of the Peninsula. A single specimen from Sambhur 1869 is in the Hume collection but in this neighbourhood the bird must be very rare as it does not occur in Adam's original Sambhur list. It is however not uncommon at Mt. Aboo and Deesa and from there extends through Baroda, Western Khandesh (Dhulia, Nundurbar, Khondabhari ghat), Nasik and the whole range of the Sahyadris (Khandalla, Mahableshwar) with their adjoining districts. Fairbank is careful to emphasise that in this area it is very definitely a bird of the ghats and does not extend over into the Deccan (S. F., iv. 258). In the South Konkan and Kanara it is scarce, though it is apparently commoner again in Mysore. Here we are directly opposite to the southernmost limit of the typical race in the valley of the Krishna and south of this line it suffices to say here (for details will be found in the proper place) that *albogularis* is widely distributed, though not universally, in the rest of the Peninsula and Ceylon.

Dumetia hyperythra albogularis (Blyth).

Malacocerus (?) *albogularis* Blyth, J.A.S.B., xvi, 1847, (after May), p. 453—Taipoor Pass and near Jaulnah.

Specimens collected—37–39 ♂♂♂ 13-4-29, 49 ♂ 14-4-29, 107 ♀ 22 4-29, 137–8 ♂♂ 27-4-29, 156 ♂ 30-4-29 Kurumbapatti ; 254 ♀ 20-5-29, 256 ♂ 21-5-29 Shevaroy Hills 4,800 ft. , 327 ♂ 5-6-29, 408 ♂ 14-6-29 Chettiri range 2,000–3,000 ft. ; 539 ♀ 544–5, ♂ ♀ 17-7-29 Gingee ; 648–9 ♀ ♂ 4-8-29, 671 ♀ 9-8-29, 684 ♀ 13-8-29, 691 ♂ 14-8-29, 692 ♂ 15-8-29, 724 ♀ 21-8-29, 731 ♀ 22-8-29, 742–3 ♂♂ 24-8-29 Palkonda Hills 1000 ft. ; 774–5 ♂♂ 31-8-20, 826 ♀ 18-9-29, Koduru ; 933–4 ♂♂ 20-10-29 Seshachalam Hills 2,000 ft. ; 999 ♀ 11-11-29, 1033–4 (♀♂) 25-11-29 Nallamalai range 2,000 ft.

Measurements (excluding the intermediate Nallamalai birds)—

	Bill.	Wing.	Tail.	Tarsus.
21 ♂	13-14·5	53–61·5	59-69	18·5-20·5 mm.
10 ♀	12·5–14	54–58	59·5-69	17–19 5 mm.

D.h. albogularis differs from the typical race in being rather lighter and brighter in tint of colouration, in having a well-defined white patch on the chin and throat and the centre of the abdomen more or less white.

No significance attaches to the presence or absence of black shafts to the feathers of the white gular patch or pale shafts to the feathers of the forehead, except that the former are not found at all in the typical race.

Harington separated birds from Mt. Aboo, Deesa and the west coast down to Mahableshwar as *D.h. abuensis* (J.B.N.H.S., xxiii, 1915, 429—Mt. Aboo) as having the rufous of the forehead deeper and more extensive and the under parts darker. This we do not accept. The latter character certainly does not hold while the former appears to be a matter of individual variation. It is noteworthy that the Sambhur specimen agrees in every respect with topotypes or even Ceylon birds. Two juveniles from Mt. Aboo are quite indistinguishable from the juvenile of the typical form.

The Survey found the White-throated Babbler a very common bird. In Salem district it was common everywhere both in the plains, forests or wherever there were hedges or sparse jungle to provide the necessary cover. On the Shevaroys and Chitteri range they were found up to 4,000 ft. At Gingee in South Arcot, at Ballepalle Gulvalacheruv and the Palkonda Hills (1,000 ft.) and Koduru in South Cuddapah and in the Seshachalam Hills (2,000 ft.) it was equally common. It was recorded at Horsley Konda by Roscoe Allen (J.B.N.H.S. xviii, 907). In the Nallamallai range (2,000 ft.) of S. Kurnool it was also common and the specimens from the last locality show definite intergradation with the typical race whose range starts between the Krishna and Godavery rivers.

As to the distribution of the White-throated Babbler in the rest of the Presidency it is known to occur in the Palnis, it is common from 1,000 ft. to 3,000 ft. in the hills of Travancore, William Davison shot it at Neddivatum 6,500 ft. and Col. H. R. Baker at Segore 4,000 ft. in the Nilgiris and the former found it in many places in the Wynaad.

The breeding season is apparently not so well defined as in the typical race, but varies from the middle of April to the middle of October, irrespective of locality.

Chrysomma sinensis sinensis (Gmelin).

Parus sinensis Gmelin, Syst. Nat. vol. i, Part ii (1789), p. 1012—China.

Specimens collected :—64 ♂ 16-4-29, 106 ♂ 22-4-29, 148 28-4-29, 193 4 ♂♂ 6-5-29, Kurumbapatti ; 656 ♂ 6-8-29, 718 ♂ 20 8-29, 739 ♂ 24-8-29 Palkonda Hills 1,000 ft.; 804 ♂ 11-9-29 Kodur 500 ft.; 932 ♂ 20-10-29 Seshachalam Hills 2,000 ft.; 1473 ♀ 4-3-30, 1493 ♀ 7-3-30, 1520 ♀ 11 3-30, 1552 ♀ 16-3-30, 1574 ♀ 20-3-30, 1625-6 ♂ ♀ 30-3-30, 1655 ♀ 4-4-30, 1678 ♂ 12-4-30 Sankrametta 3,000-3,500 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
11 ♂	13·5–14·5	64·5–70	73·5–92·5	24–26·5 mm.
7 ♀	13·5–14·5	63–69	79–89·5	25–27 mm.

The Yellow-eyed Babbler must be very generally distributed in the Presidency though there are very few details about it actually on record.

La Personne reports that it was quite common on the sparsely covered hillsides about Sankrametta, keeping in March and April in little parties of five and six. In Cuddapah district (August to October) it was only seen in bushy country outside the forest, where the birds were in pairs and very shy and wild, evidently breeding. It was not noted in the Shevaroys or the plains below the Chitteri hills but about Kurumbapatti it was found in small numbers in hedges and sparse jungle.

On the west it seems to be much less common, doubtless because of the humidity of that side. Hume thought he had seen a specimen from the Wynaad (S.F., x. 373) and it certainly occurs in the Nilgiris as William Davison shot a specimen about 6 miles from Ootacamund and Miss Cockburn knew of it breeding at Kotagherry. Jerdon found it at Wulliar and also near the base of the Shandee Mungalum hills (wherever they may be).

Throughout its range in India the Yellow-eyed Babbler breeds during the rains. Eggs may be found from May to October but the vast majority will be found from the end of July to the beginning of September. The post-nuptial moult is therefore very late, and there is a correspondingly late partial spring moult. This fact is of importance as it has obscured the change of length of tail in summer and winter plumage, which the Yellow-eyed Babbler shares with other birds of similar facies, e.g. *Prinia* and *Suya*. The central pair of tail feathers are moulted in spring and the summer pair are shorter than the winter pair.

In our first report (J.B.N.H.S., xxxiv, p. 393) we mentioned that Ticehurst and Stuart Baker differed in their treatment of this species but the difference has since been removed by Stuart Baker's later agreement (*New Fauna*, viii, p. 44) in Ticehurst's recognition of a pale race *hypoleucus* of Franklin in the dry north-west. Both agree that the birds of the rest of India agree with the typical form. We do not quite understand what Mr. Stuart Baker considers the type locality for *sinensis*. In vol. I, p. 233 he gives Sina = China, but in vol. viii, p. 45 he says that China is an error, without however specifying any other locality. As a matter of fact there is no difficulty in accepting China as the type locality. Latham (on whose description Gmelin's name is based) says that he described the bird from drawings in the possession of Captain Broadley and that the bird came from China. The species certainly occurs in S.-W. China, e.g. Kwangtung, Kwangi and Yunnan (La Touche, *Birds of E. China*, pt. i, p. 72).

We cannot however satisfy ourselves that the bird of the Eastern ghats and India generally, exclusive of the range of *hypoleucus*, is the same as the Chinese bird. There are only two Chinese specimens (Vaughan) in the British Museum and of these the male (March) has a tail of 105 mms. La Touche separated the Yunnan birds as *Pyctorhis s. major* on the ground of size, but unfortunately he compares them with our Indian bird and not topotypes. We suspect that Yunnan and Chinese birds will prove to be definitely larger than South Indian specimens of which the great majority have tails below 90 mm. Until however we are able to examine a reliably sexed series from China we are unable to settle the point. Allowance will also have to be made for the seasonal change in length of tail. For the moment therefore we are compelled to accept the usual identification of these southern birds as belonging to the typical form.

Pellorneum ruficeps ruficeps, Swainson.

Pellorneum ruficeps Swainson, Fauna Boreal. Amer. 1832 (Febr.) p. 487—India.

Specimens collected :—86 ♀ 19-4-29, 118–9 ♀♂ 24-4-29, 183–4 ♀♂ 4-5-29 Kurumbapatti; 215 ♂ 13-5 29, 224 ♂ 15-5-29, 243 ♀ 17 5-29, 275 ♀ 23-5-29 Shevaroy Hills 3 500 ft.; 305 ♂ 2-6-29, 328 ♂ 5-6-29, 366–7 ♂♂ 8-6-29, 394 juv. 12-6-29, 420 ♂ 15-6-29 Chitteri range 2,000 ft.; 630, 633, 635 ♂♂♂ 1-8-29, 650 ♂ 4-8-29, 672 ♂ 10-8-29, 697 ♂ 16-8-29, 711 ♀ 19-8-29, 745 ♀ 24 8-29, 747 ♂ 25-8-29 Palkonda Hills 1,000 ft.; 1339–40 ♂♀ 6-2-30, 1347 ♀ 7-2-30, 1405 ♀ 18-2-30, 1409 ♂ 19-2-30, 1485 ♀ 6-3-30, 1768 ♂ 4-5-30 Anantagiri 3,000 ft.; 1,480 ♂ 6-3-30, 1609 ♀ 26-3-30, 1617 ♂ 28-3-30 Sankrametta 3,000–3,500 ft.; 1,714a ♂ 21-4-30, 1724 ♀ 24-4-30 Jeypore Agency.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
22 ♂	17–20	68·5–77	61·5–70	25–28 mm.
14 ♀	16·5–19·5	66–73·5	57·5–69	25–27·5 mm.

This is another species of which the Indian distribution is far from properly known. It occurs in the whole of the ranges of Western India from Nandarbar in Khandesh down to the hills of Travancore. It is fairly common in Pachmarhi (Osmaston, J.B.N.H.S., xxviii, 454) and Thompson obtained it in Mundla District in the centre of the Peninsula; while on the east side it is found in the Rajmehal Hills (Ball, S.F., ii. 409), on Parisnath Hill (Brooks), in a patch of country about Maunbhum and Dholbhum (Tickell and Beavan) whilst La Personne found it common and widely spread in the hills of the Vizagapatam District about **3**,000–3,500 ft. South of this area, it is not recorded again until we come to Horsleykonda (Roscoe Allen, J.B.N.H.S., xviii, 905) and the Palkonda Hills where La Personne found it common at 1,000–2,000 ft. In Salem District it appears to be common at all heights up to 4,500 ft. wherever thickets supply the necessary cover and from here in addition to La Personne's notes and specimens from Kurumbapatti, Shevaroys and Chitteri range, there are specimens in the Indian Museum collected by Daly in the Shevaroys and Beadnell's notes on the breeding of the bird at Yercaud (J.B.N.H.S., xxix, 292). Whether it occurs on the tableland of the Deccan proper is unknown.

It is not uncommon in the Nilgiris, the Wynaad and the Brahmagiris and in Coorg.

Throughout the wide range outlined above, except in the areas mentioned under *P. r. granti*, the bird remains remarkably constant in size and colouration though in the north-east about Orissa there is a tendency for the colouration to grow slightly richer in tint but not sufficiently to warrant the separation of a subspecies.

The breeding season is regular throughout India from March to June, earlier in these limits in the east and south and later in them in Pachmarhi and the Bombay Presidency.

Pellorneum ruficeps granti, Harington.

Pellorneum ruficeps granti Harington, Bull. B.O.C., xxxiii, 1913 (Dec. 10), p. 81,—Mynall, Travancore.

This very richly coloured race is rare in collections and it appears also to be rare in life in Travancore. Bourdillon (S.F., iv. 399) says that he only procured one at 2,500 ft and Ferguson (J.B.N.H.S., xv, 258) says that he only met two in January 1901 on the Cardamum Hills at 3,000 ft. A spotted Babbler said to be common in the Nelliampathis (Kinloch, J.B.N.H.S., xxvii, 940) and in the Palnis (Fairbank, S.F., v. 404) is presumably also of this race but no specimens exist. The same applies to the records for Palmaner, Chittoor District (Hasted) and Trichur (Jerdon).

Stuart Baker (*New Fauna*, vol. i, p. 240) extends the range of this race to the Wynaad, Coorg and S.-W. Mysore thereby cutting off the typical race in the Nilgiris from the rest of its habitat on the Western ghats proper. With this we are unable to agree. The most that can be said is that some specimens from the low jungles of Malabar, Coorg and the Wynaad are intermediate, showing the intergrading of the two races. Birds from Mysore and the Nilgiris certainly belong to the typical race.

The breeding season is not recorded.

Stachyridopsis rufifrons ambigua Harington.

Stachyridopsis rufifrons ambigua Harington, J.B.N.H.S., xxiii, 1915 (May), p. 631—Gunjong, N. Cachar.

Specimens collected :—1504 ♀ 9-3-30, 1595–97 ♂ ♀ 24-3-30 Sankrametta 3500 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
♂	15	55·5	53	19·5 mm.
2 ♀	14	53	48·5–51	...

The above specimens represent the only record of the Red-fronted Babbler in Peninsula India. La Personne's note is as follows :—Not quite so common as *mixornis* and appears to inhabit higher altitudes ; specimens were secured at 3,500 ft.-4,000 ft., always in thick forest in ravines. In habits they at times resemble the fly-catchers, often catching their food on the wing. Extremely shy birds. They do not move about in parties at this season (March–April).

Mixornis gularis rubricapilla (Tickell).

Motacilla rubicapilla Tickell, J.A.S.B., ii, 1833 (after November), p. 576—Borabhum, in Manbhum.

Specimens collected :—1606 ♀ 26-3-30, 1618 ♂ 28-3-30, 1642 ♀ 2-4-30, 1662 ♂ --4-30 Sankrametta 3,000 ft. ; 1736 ♂ 27-4-30 Jeypore Agency 3,000 ft. ; 1766 ♀ 545-30 Anantagiri 3,000′.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	15	59–62	53–57·5	18–18·5 mm.
3 ♀	14·5–15·5	57–59·5	50·5–55	18·5–19 ,,

Previously unknown to occur in the Madras Presidency. Met with by the Survey only within the Vizagapatam District. La Personne's note is as follows :—I found it quite common at Sankrametta 3,000 ft. where it was breeding. Towards the latter end of April these birds were observed nest-building, the material being taken from a fish-tail palm. The birds take hold of a strand from the palm and then appear to drop earthwards, the weight of their bodies stripping the strand from the outer-coverings of the palm. They move about in small parties keeping well under cover and are quite undistinguishable from *Dumetia* in their habits and movements.

The Yellow-breasted Babbler might have been expected to occur in Vizagapatam ; for it was first found in Borabhum and Dholbhum by Tickell and later by Beaven on the banks of the R. Cossye. Chota Nagpore was included in consequence in the distribution in the *Old Fauna* though omitted again in the *New Fauna* (in spite of the fact that the type locality falls within the area). Whilst further to the south-west it was discovered at Parasgaon in Bastar State by D'Abreu (J.B.N.H.S., xxiii, 154).

Alcippe poioicephala poioicephala (Jerdon).

Thimalia poioicephala Jerd., Madr. Jour. Lit. Sci., xiii, 1844 (after April), p. 169—Coonoor ghat, Nilgiris.

The range of this race of the Quaker-Babbler lies to the west of the area covered by the Survey. It is fairly common in the Travancore Hills at 2,000 ft. and upwards and is perhaps most numerous in the High Range. It is also common in the Palnis but has not been recorded from the other ranges of this group. In the Nilgiris it is exceedingly common up to 6,000 ft, and thence it extends into the Wynaad and Brahmagiris. Birds from the areas round about Goa are intermediate in character.

The breeding season is from January to June. At Culputty, S. Wynaad, Mr. Darling, Jnr., found a nest as late as October.

Alcippe poioicephala brucei Hume.

Alcippe brucei Hume, J. A. S. B., xxxix 1870 (June 7), p. 122—Mahableshwar.

Specimens collected :—200-1 ♂♂ 11-5-29, 211-12 ♀♀ 12-5-29, 226 ♀ 15-5-29, 247 ♀ 18-5-29 Shevaroys 3,500 ft. ; 428 ♀ 16-6-29, Chitteri Hills 3,000ft. ; 1345-6 ♂♀ 7-2-30, 1356-59 ♂♀ 9-2-30, 1362-65 ♀♀ 10-2-30, 1775 ♂ 5-5-30 Anantagiri 3,000ft. ; 1469 ♀ 4-3-30, 1475 ♀ 5-3-30, 1512-3 ♀♂ 10-3-30, 1519 ♀ 11-3-30, 1526 ♂ 12-3-30 1532 ♀ 13-3-30, 1557 ♀ 17-3-30, 1569 ♂ 19-3-30, 1594 ♀ 24-3-30, 1622 ♂ 28-3-30, 1648 ♀ 3-4-30, 1675 ♂ 12-4-30 Sankrametta 3,500 ft.-3,800 ft. ; 1713 ♂ 21-4-30, 1735 ♀ 27-4-30, 1750 ♀ 30-4-30 Jeypore Agency 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
12 ♂	15–17	69·5–77	64·5–70·5	21–24 mm.
18 ♀	15–16·5	67–74	61·5–70·5	21–23 ,,

This race of Quaker-Babbler, not previously known to occur within the Presidency, was found by La Personne in considerable numbers in the Shevaroys and Chitteri ranges about 3,000ft.-4.000ft. and again on the summits of the hills in the Vizagapatam District at about 2,500ft. to 5,000ft. In the latter direction the bird must be fairly widely spread as D'Abreu (Jour. B.N.H.S., xxiii, 154.) procured a specimen on January 22, at Parasgaon in Bastar State and Walton procured it at Kutri, Daspalla, Orissa on February 4, 1902.

We cannot separate these birds in any way from those of the Western ghats where the species occurs from the Goa frontier to W. Khandesh and Rajkote in Kathiawar; whilst Hume's specimen in the B. M. from Parasnath Hill, D'Abreu's statement that it is in common in the Baihar Tehsil of the Balaghat District and the fact that the bird is not uncommon at Pachmarhi (B.B. Osmaston, J.B.N.H.S., xxviii, 454) suggest that the distribution is wider than is at present known.

At Pachmarhi it breeds early in July according to Osmaston and eggs were found in Khandesh on August 16.

Rhopocichla atriceps atriceps (Jerdon).

Brachypteryx atriceps Jerdon, Madr. Jour. Lit. Sci., vol. x, 1839 (October), p. 250—Trichoor.

Rhopocichla atriceps bourdilloni (Hume).

Alcippe bourdilloni Hume, S. F., iv (1876 December), p. 485—Mynall, Travancore.

Not met by the Survey.

The Black-headed Babbler is very common in Coorg and the Wynaad, in the Nilgiris up to about 5,500 ft., and in smaller numbers beyond our limits into some part of Mysore and along the Western ghats at least as far as the neighbourhood of Belgaum. Southwards there is some doubt as to its exact distribution. There is a specimen in the British Museum from the Palghat Hills, and in the Nelliampathy Hills, according to Kinloch, it is very common. The type locality Trichoor in Cochin State is close to the Nelliampathies.

South of this again throughout the hill ranges of Travancore and in the High Wavy Mountains of Madura (where a specimen was collected by Mr. Prater) it is said to be replaced by a different race *R. a. bourdilloni*. This differs in having the black cap replaced by brown and the under parts ferruginous.

We are by no means certain that this supposed race is not merely founded on the juvenile plumage. If not it is curious that the division between the races should occur on the Cochin-Travancore border and not at the Palghat Gap. Whilst Ferguson's statement (J.B.N.H.S., xv, 260) that both forms occur throughout the Travancore Hills, though *atriceps* is far less common, in any case should prevent their being treated as geographical races, if different.

Unfortunately the series in the British Museum does not settle the point. The characters by which one can generally recognise the young of Timaline birds —a blunt broad first primary and 'decomposed' feathers, particularly in the under tail coverts—are found in both black-headed and brown-headed specimens. Until therefore the question has been settled by careful observation and dissection in the field we do not like to upset the accepted division, based on the fact that all specimens in the British Museum with black heads come from the north of the range and all with brown heads from the south.

The Ceylon race *R. a. nigrifrons* is of course quite distinct.

Nests may be found practically throughout the year but the main breeding season seems to be from March to July. The bird is semi-colonial in its breeding habits.

Ægithina tiphia humei Stuart-Baker.

Specimens collected :—18-19 ♂ Imm. ♀ 11-4-29, 42 ♀ 13-4-29, 77 ♀ 18-4-296 99-101 ♂♂♂ 21-4-29, 189-190 ♂♂ 5-5-29 Kurumbapatti ; 287 ♂ 29-5-29, 314-1, ♂♂♀ 322 ♂ 3-6-29, Chitteri range 2,000 ft. ; 440 ♂ 18-6-29 Harur 1,000 ft. ; 490 ♂ Imm. 3-7-29, 508 ♀ 4-7-29, 523 ♂ 6-7-29 Kalai ; 541-2 ♀ ♂ 17-7-29, 546 ♂ 18-7-29, 568 ♂ 20-7-29 Gingee ; 634 ♂ 1-8-29, 647 [♂] 4-8-29, 685 13-8-29, 689 ♂ 14-8-29, 709 ♀ juv. 29-8-29, 712 ♀ 19-8-29 Palkonda Hills 500-1000 ft. ; 786 ♀ 2-9-29 Kodur 500 ft. ; 853 ♂ 30-9-29, 856 ♀ 1-10-29, 919 ♀ 14-10-29 Seshachalam Hills 2,000 ft. 948 ♀ 31-10-29, 993 [♂] 9-11-29 Nallamallai Range 2,000 ft.; 1107 ♂ 14-12-29, 1134 ♂ 18-12-29 Cumbum Valley; 1321 ♂ 5-2-30, 1330 ♀ 6-2-30, 1432 ♀ 23-2-30, 1754 ♂ 2-5-30 Anantagiri 3,000 ft. ; 1565 ♂ 19-3-30, 1663 ♂ 5-4-30, 1674 ♂ Imm. 12-4-30 Sankrametta 3,000-3,500 ft. ; 1737 ♂ 28-4-30 Jeypore Agency 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
27 ♂	16-19	61-69	44-51	18-20 mm.
3 ♂ Imm.	17·5-18·5	61-64	48-53	18·5-20 ,,
14 ♀	16-18·5	62-67	46·5-54	18-20 ,,

The Iora is found practically throughout India except in those dry areas west of a line drawn, roughly speaking, from the head of the Gulf of Cambay through Mt. Aboo to Kangra. In the Madras Presidency it is apparently common throughout the whole of the plains and all but the highest peaks of the various ghat ranges of the eastern side upto about 4,000 ft. In the south-west it seems to be more definitely a bird of the plains as it avoids the Palni Hills and the Travancore ranges south of the Palghat Gap. North of that gap it is again found in the hills and is common in the lower slopes of the Nilgiris, upto 3,000 ft. and in the Wynaad and Coorg.

The identification of the huge series obtained by the Survey has only confirmed the accuracy of Hume's most able exposition in Stray Feathers (S. F., v. pp. 434-41) of the facts regarding the variation of this bird throughout India, except that with an additional number of specimens available for examination we find that his supposed race in the Central Provinces is not as clearly defined as he thought. The facts are not in dispute. It only remains to express them in terms of subspecies and trinomial nomenclature, and we find ourselves unable to agree with the arrangement accepted in the *New Fauna*.

The study of this species is exceedingly difficult and nothing can be accomplished unless the general principles underlying the variations in plumage are clearly understood in advance.

The juvenile plumage is, roughly speaking, similar to that of the female. After the post-juvenal moult the sexes are alike and cannot be distinguished from the adult female, which is alike in summer and winter plumage and lacks any black on the body plumage or tail and has the black of the wing coverts and quills much duller and grayer. Whether the young male normally breeds in this female plumage is not very clear. Hume says (S. F., v. 430) that it assumes the black tail in March and April but sometimes at any rate it breeds in the female plumage and assumes the black tail and wings at the post-nuptial moult about July. After the second autumn it certainly is not distinguishable from the adult and then always has the black tail.[1]

The adult male has a distinctive summer and winter plumage, the former being assumed by a partial spring moult. The summer plumage in Ceylon consists of the upper parts being deep almost unbroken black, except for the yellow rump, and the under parts are bright canary yellow. In extreme north-western India on the other hand the upper parts in summer plumage are green as in winter. In some specimens there is an occasional black feather or a faint mottling with black on the upper parts. The lower parts are only slightly brighter than in winter plumage. The summer plumage of the north, in other words, agrees with the winter plumage of the south.

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[1] The tail is black in the adult male, summer and winter of *Æ. t. humei* in spite of the statement to the contrary in the *New Fauna*, vol. i., p. 343.

In winter plumage in Ceylon (and perhaps south-west India) there is a certain amount of black on the upper plumage and this is never found in winter plumage in the extreme north.

Between the extremes as thus outlined there is a very gradual and general transition throughout the Peninsula, only interrupted by individual variation and an east to west intergradation in the centre of the Peninsula with *Ægithina nigrolutea*. The main breeding season is in the rains from June to August but nests may be found from March to October. The result is rather prolonged and irregular moulting dates which tend to obscure the recognition of breeding and non-breeding plumages.

The position of Marshall's Iora (*Æ. nigrolutea*) is very hard to understand. In appearance and plumage stages it would seem to be merely another subspecies of the Common Iora. The striking contrast between the black crown and golden collar, the black tail of all known plumages (the juvenile plumage is unknown), the amount of white on the wings and tail are merely the perfection of features which are present in the races of *tiphia*. On the east it evidently intergrades with *tiphia* for the variety mentioned by Hume on p. 439 of his exposition and crystallised by Mr. Baker as his race *humei* is nothing more or less than an intermediate between the two species. Yet on the west *nigrolutea* extends as a solid wedge between the green-backed bird of the north-west and the black and yellow backed birds of southern India generally, neither intergrading with them nor allowing intergradation between them. Its range embraces Cutch, Guzerat, Western Khandesh, Eastern Rajputana, the south-east Punjab and the south-west United Provinces, extending eastwards to an extent not satisfactorily verified but apparently to Chota Nagpur (Hazaribagh and Lohardugga). This range is largely complementary to that of the forms of *tiphia* but in one or two areas, e. g. western Khandesh (S. F., x. 306) there seems little or no doubt that *nigrolutea* and *tiphia* subsp. are found and breed in the same area. It seems almost as if *nigrolutea* was really a subspecies of *tiphia* which towards its western limits has reached the status of a full species and as such is able in turn to invade the distribution of another subspecies of the parent form. Possibly however, once attention is directed to the problem, further observation will establish that the overlapping is not so wide as the incomplete data available appears to suggest, and that *nigrolutea* will finally be accepted as a race of *tiphia*. At present however we are hardly justified in drawing this conclusion and do not do so.

Mr. Baker's arrangement is this. Ceylon and South Travancore are assigned to *Æ. t. multicolor*. The whole of the rest of the range in India is assigned to *Æ. t. tiphia*, as well as Assam, Burma, the north of the Malay Peninsula, western Siam and Annam. Out of that immense range, south central India is reserved for *Æ. t. humei* the intermediate.

There is an unsatisfactory want of proportion about this arrangement. It separates the birds of north and south Travancore,—both of which are black above in breeding plumage,—on a difference of tint which is certainly hard to appreciate if it exists at all. It unites the bird of north Travancore, where the black-backed summer and green-backed winter plumages are absolutely different, with the bird of the extreme north-west where summer and winter there is no change in the green backed plumage. Yet accepting these marked differences as negligible it singles out a section of the intermediate chain between them, at the point where there is also intergradation with *nigrolutea*, and separates it as a valid race. Surely thus the part becomes greater than the whole.

The explanation is of course that Mr. Baker has merely accepted the distinctions enumerated by Hume at their face value and given a name and a subspecific value to them. One has only to examine extra material to realise that the differences given by Hume are neither constant nor confined to that particular area. The golden collar of the male can be traced far further south and west gradually dying out into the unbroken black of true *multicolor*; whilst the pale colour of the female appears throughout our Survey series all the way down to Salem district. Luckily Mr. Baker has placed his type locality as far south as Raipur so the name can be retained though the construction, we placed on it is different.

We propose therefore to recognise the following races.

Ægithina tiphia tiphia (L.).

Motacilla tiphia Linn. Syst. Nat. Ed., x. (1758), vol. i, p. 186,—Bengal, restricted to the neighbourhood of Calcutta.

♂ Summer and winter plumage normally alike a rather dull dark green, the black on the upper plumage in summer being obsolete (Punjab) confined to faint traces of mottling or occasional black feathers (United Provinces) or patches (Bengal). Lower plumage duller and greyer in winter and less bright yellow in summer.

♀ duller and greyer than in *Æ. t. humei.*

The Himalayan foothills and the adjacent plains from Gurdaspur to northern Assam, the United Provinces, and Bengal extending into Burma.

Ægithina tiphia humei Stuart Baker.

Ægithina tiphia humei Stuart Baker, Fauna, B. I. Birds (2nd ed.), vol. i, July 1922 (= August 16, 1922), p. 342—Raipur, Central Provinces.

♂ in summer with black predominant in the upper plumage and often considerable traces of a yellow collar on the hind neck.

♂ in winter plumage and ♀ a clearer and paler green than *Æ. tiphia tiphia.*

The whole of India south of a line roughly from Mt. Aboo through Central India to Orissa.

Ægithina tiphia multicolor (Gmelin.)

Fringilla multicolor Gmelin, Syst. Nat , vol. i, part ii (1789), p. 924—Ceylon.

♂ in summer plumage is altogether a darker bird with the black of the upper plumage more extensive and less broken by yellow bases ; the second wing-bar is generally absent. Lower plumage very bright canary yellow.

♂ in winter plumage a darker and duller green, in some specimens washed with black producing a curious sooty appearance not found in the Indian races.

♀ on the average darker than in other races.

Ceylon and Rameswaram island.

Chloropsis aurifrons davidsoni Stuart-Baker.

Chloropsis aurifrons davidsoni; Stuart Baker, Bull. B.O. C., xli. 1920, (Oct.) p. 8—Malabar.[1]

Specimens collected .—227 ♂ 15–5–29 Shevaroy Hills 3,500 ft. ; 632 ♂ 1–8–29 Palkonda Hills ; 966 ♀ Imm. 3–11–29, 980–81 ♂, ♀ Imm. 7–11–29, 1023 ♂ 22–11–29 Nallamalai Hills 2,000 ft. ; 1355 ♂ 9–2–30, 1400–1403 ♀♀ 17–2–30, 1404 ♂ 18–2–30 Anantagiri 3000 ft. .

Measurements—

	Bill.	Wing.	Tail.	Tarsus,
6 ♂	23–24·5	95–101·5	70–77	18·5–19·5 mm.
4 ♀	22·5–25	91·5–95	68–71	18–19 mm.

In identifying our specimens of the Malabar Chloropsis we immediately noticed a distinction in size between the birds obtained in the Eastern ghats and those from Ceylon and Travancore. The latter measure as follows :—

	Bill.	Wing.	Tail.
6 ♂ Ceylon	22–25	91–94	65–70 mm.
4 ♂ Travancore	23–24	86·5–93·5	65–66 ,,
3 ♀ Ceylon	23·5–24·5	87·5–88·5	59·5–64 mm.
2 ♀ Travancore	22·5–23	87–88	64·5 mm.

There is thus no overlapping in size with our Survey series and it is evident that a large and small race require recognition, in addition to the differently coloured bird of N.-E. India. On the western side where the range is continuous there is a gradual transition in size between the large and small forms, but there is no difficulty in deciding that all birds from the Nilgiris northwards belong to the large form. The Palghat gap may therefore for convenience be fixed as the boundary between the two forms, and we propose to name the small southern form.

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[1] *Nom. Nov.* for *Turdus malabaricus* Gmelin, Syst. Nat., 1788, p. 837—Malabar, pre-occupied.

Chloropsis aurifrons insularis subsp. nov.

Type: ♂ 18-6-1878 Cotta, N. P., Ceylon (Hart Bros.) British Museum, Reg. no.

Although the range of the Malabar chloropsis *C. a. davidsoni* is given in the *New Fauna* as the 'West Coast of India, Khandala to Ceylon', it was already known to occur in the Shevaroys, whence four specimens collected by Daly are enumerated in Finn's catalogue of the Indian Museum. It has remained however for La Personne to extend its known range to the whole length of the Eastern ghats as shown by the list of specimens. There is, however, some doubt as to the boundary between this and the typical race, as although the latter occurs in Midnapur and Maunbhum there is nothing to show which race occurs at Kalahandi (Ball) and Gumsoor (Jerdon).

In the west of the Presidency this *Chloropsis* is common in Malabar, Coorg, the Wynaad and the Nilgiris up to 6,000 ft.

The female is wrongly described in the *New Fauna*. As in the typical race she agrees closely with the male and is only distinguishable by the smaller, duller patch of orange on the forehead, the smaller blue carpal patch and the slightly smaller size. In first winter plumage both sexes lack the orange forehead, while the black gular patch and blue moustachial streaks are replaced by pale green, though the premature moult of a few feathers usually foreshadows the adult plumage.

The breeding season in the Presidency is unknown. Colonel Sparrow informs us that about Eswantaraopett near Secunderabad nests may be found from the end of June to the middle of August, but that most eggs will be found in early July. In N. Kanara, on the other hand, James Davidson found a nest with young at Sampkund (Sirsi Taluka) on February 18.

Chloropsis aurifrons insularis subsp. nov.

This small race is common in the hills of Travancore up to 4,000 ft. and also apparently in the Nelliampathis. There is no record from the Palnis.

The breeding season in this area is unknown but the *New Fauna* records a nest with two eggs in Ceylon on January 25.

Chloropsis jerdoni (Blyth).

Phyllornis jerdoni, Blyth, *J.A.S.B.*, xiii 1844, (after December), p. 392 Goomsoor.

Specimens collected:—98 ♂ Imm., 20-4-29, 187 ♂ 5-5-29 Kurumbapatti; 350 ♂ 7-6-29, 372 ♂ 9-6-29, 438 ♂ 17-6-29 Chitteri range 2,000 ft.; 522 ♀ 6-7-29 Kalai, Trichinopoly; 832 ♀, 833 ♂ 19-9-29 Kodur, S. Cuddapah; 967 ♂ 4-11-29 Nallamallai Range 2,000 ft.; 1718 ♂, 1719 ♀ 23-4-30 Jeypore Agency 2,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
8 ♂	21·5-24	86-95	67-79	19-20·5 mm.
3 ♀	21-22	84-84·5	68-71	18-18·5 mm.

Jerdon's Chloropsis is very widely spread within the Presidency. Although it is common in Chota Nagpur there is little definite evidence in support of Jerdon's statement that it is extremely common in the jungles of the Eastern ghats (Ill. Ind. Orn.). Jerdon himself specifies Goomsoor as a locality (Madras Jour. Lit. Soc., 1839, 247). Otherwise La Personne's specimens (♂ ♀ April 23) from the Jeypore Agency 2,000 ft., from the Nallamalai range 2,000 ft. (♂ November 4) and from the Chitteri range 2,000 ft. (♂♂♂ June) complete the known records for the Eastern ghats.

In the Carnatic, on the other hand, Jerdon considered the bird as rare, and this agrees with the experience of the Survey. At Kodur, S. Cuddapah, La Personne procured a pair on September 19, noting it as not plentiful, and in Salem District he says that it was not common, isolated pairs being met with over a large area. A female was procured at Kalai, Trichinopoly.

In the west of the Presidency it is certainly more common though perhaps less of a hill bird. Throughout Travancore it is a very common bird in the low country at the foot of the hills but it does not ascend them (Ferguson

J.B.N.H.S., xv. 262). There are 4 specimens in the British Museum labelled Anjango[1] in December 1872 as well as one of Fry's 'Trivandrum' specimens.

In the Palnis, Fairbank obtained a specimen (now in the British Museum) at 4,000 ft. (S.F., v. 406). Kinloch did not meet with this species in the Nelliampathis but it is said to have been observed by Mr. W. A. Hasted at Palmaner, Chittoor District (Baker & Inglis, *Birds of S. India*, p. 23).

Davison did not meet it in the Nilgiris but in the British Museum there are specimens from Kullar (Wardlaw-Ramsay), Coonoor (Day) and the 'base of the Nilgiris' (Hume Coll.). In Malabar and doubtless S. Canara it seems to be generally distributed though there are no records for Coorg and the Wynaad.

The seven specimens labelled 'Madras' in the British Museum (Baber, Elliot, Reeves) may be disregarded.

The general distribution of this species as given in the *Fauna* is correct. Ceylon birds are not separable though they do not attain the maximum length of Indian birds. The bird is strictly resident and the breeding season is a poorly defined one from February to August without any particular difference in any part of the wide range in India.

The juvenile plumage differs from that of the adult female in the absence of the yellow wash on the forehead and in the fact that the green gular patch, the yellow nimbus to it and the blue moustachial streak are all very indistinct and shadowy, blending in with the green of the lower plumage. In first winter plumage both sexes resemble the adult female (the moustachial streak being present in spite of the statement to the contrary in the *New Fauna*) but in the male the gular patch is soon flecked with black owing to the accidental moult of odd feathers.

Microscelis psaroides ganeesa (Sykes).

Hypsipetes ganeesa Sykes, P.Z.S., 1832 (July 31), p. 86—Dense woods of the ghats, [= Mahableshwar].

Specimens collected :—206–208 ♂ ♀♀ 12–5–29, 216 ♀ 13–5–29, 219 O ? 14–5–29, 263 ♂ 21–5–29 Shevaroy Hills 3,500–4,800 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	27	118–119	99·5–102	16·5–18 mm.
3 ♀	25–26·5	111–115·5	95–101	16·5–17 mm.

The Black Bulbul was only met with by the Survey on the Shevaroy Hills where it was abundant and evidently breeding at about 4,500 ft. It had already been recorded from this range by Daly, 4 of whose specimens are in the Indian Museum. With the exception of this locality and McMaster's unlikely[2] record from Chikalda on the Gawilgurh Hills in Berar (*J.A.S.B.*, 1871, p. 211), this race is confined to the hill ranges of the Western ghats from Matheran down to Cape Comorin, occurring normally at fairly high elevations.

Within the Presidency it is recorded as follows. In Coorg, according to Betts, it is decidedly uncommon as an occasional wanderer from higher elevations. William Davison found it in the Brahmagiris, but the only record for the Wynaad is a bird in the Bombay Society's collection obtained at Petcholi by J. P. Cook. In the Nilgiris, it is widely distributed and very common on the higher parts from 6,000–8,000 ft., only occurring below 4,000 ft. as a scarce wanderer out of the breeding season. Kinloch found it very common in the Nelliampathis, and in the Palnis and the Travancore Hills it is found at all elevations but is particularly common from 3 000 ft. up to the highest peaks.

Although a resident throughout its range this race must indulge in considerable local movement in the non-breeding season when large flocks collect. Rhodes Morgan recorded how in July in the Bolumpatty Valley he saw them travelling in vast flights, numbering several thousands, flying westwards in the direction of Travancore. Captain Betts states that they desert the western side of the Nilgiris almost entirely during July and August when the S.-W. monsoon is at its height.

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[1] This locality Anjango on many birds in the British Museum must be regarded with caution. Ferguson (loc. cit., p. 264) explains that there used to be several shikaris at Anjango who made a living by collecting and selling birds from the hills. They never labelled them and always said they were from Anjango.

[2] It will be remembered that inexperienced ornithologists often confuse Black Bulbuls and Drongos.

They pair about February and nests may be found from about March until the middle of June ; but even during the breeding season the main flocks are said not to break up entirely.

The small series from the Shevaroys cannot be separated from the birds of the Western ghats. Birds from Ceylon however differ (as hinted by Hume S. F., i. 438) in having a distinctly larger bill. The bill in Indian birds measures for 22 ♂s 26–29, and 12 ♀s 25–28·5 mm. ; whereas in 16 birds from Ceylon (sexing not satisfactory) the bill measures (once 26) 27·5 to 32 mms. The wing is also slightly longer up to 128 mm. as compared with a maximum in India of 124·5, Indian males usually being below 120 mm. and Ceylon birds above 120 mm. in wing measurement.

This island race may appropriately be distinguished as :—

Microscelis psaroides humii subsp. nov.

Type ♂ 7-2-1892 Ceylon, Hume Collection, British Museum registered No. 1886. 9. 1. 964.

Molpastes cafer cafer (Linnæus).

Specimens collected :—50, 53 ♂ ♀ 14-4-29, 116 ♂ 23-4-29 Kurumbapatti ; 248, 250 ♀ ♂ 19-5-29 Shevaroy Hills 4,500 ft. ; 486 ♂ 2-7-29 Trichinopoly 1,000 ft. ; 557 ♂ 19-7-29 Gingee ; 636 ♂ 1-8-29, 698 ♂ 16-8-29 Palkonda Hills 1,000 ft. ; 792 ♂ 4-9-29 Kodur 500 ft. ; 871 ♀ 3-10-29, 908 ♀ 12-10-29 Seshachalam Hills 2,000 ft.

Measurements.—

	Bill.	Wing.	Tail.	Tarsus.
8 ♂	17–19	91·5–97	77–81	21·5–23·5 mm.
4 ♀	17–18	89–90	74·5–78	19·5–22·5 ,,

With the exception of the birds from the area north of the river Godavery all Red-vented Bulbuls found in the Presidency agree with the typical form of Ceylon. The species is very generally and commonly distributed except in the hill ranges where the distribution is not easy to define. In the Eastern ghats it ascends as a rule to about 2,500–3,000 ft.

In the Nilgiris, too, it is a bird of lower elevations. William Davison states that it is only occasionally found near Ootacamund but that it begins to get common just above Coonoor at about 5,000 ft. and is very common all down the Eastern slopes. On the western side, according to Betts, it is nowhere very common and does not ascend above 4,000′. Even at the foot of the slopes on the Wynaad plateau it is not numerous anywhere south of Gudalur. From Gudalur northwards it increases in numbers till it becomes a common species on the Mysore plains. In Coorg it is not common.

In the Palnis, it is found up to the summits though much commoner on the lower slopes. Yet in the Nelliampathi Hills (Kinloch, J. B. N. H. S. xxvii, 940) and in the Travancore Hills (Ferguson, J.B.N.H.S., xv, 263) it does not occur at all. Davison considered that its absence might be connected with the presence of evergreen jungle and this is probably true. But settlement and the replacing of forest by cultivation and bush jungle must have also much to do with its distribution.

There are few records published on the breeding of this race. About Madras, according to Jerdon, it breeds from June to September. In the west however it is said to breed in February and March in Travancore (Ferguson) and from February to April in the Nilgiris (Cockburn).

A melanistic bird at Madras is recorded (J.B.N.H.S. ix, 224).

Molpastes cafer saturatus subsp. nov.

Specimens collected :—1375,1379 ♂♂ 12-2-30, 1424 ♀ 22-2-30 Anantagiri 3,000 ft. ; 1646 ♀ 2-4-30 1714 ♂ 21-4-30, Sankrametta 3,500 ft. ; 1720-1 ♀ ♂ 23-4-30 Jeypore Agency 2,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
4 ♂	18–19·5	89–97·5	79–89	21–22 mm.
3 ♀	17–18	84·5–93	75–83	22 mm.

The Survey reported this bird to be very abundant in the Vizagapatam District, both in the hills and plains, and in addition to the localities where the above series was collected it was observed at Waltair and Vizianagram. Jerdon recorded it from Gumsoor. There is no information about the breeding season in this area.

The specimens obtained are certainly not the same as those obtained south of the Godaveri river. They are intermediate between *M. c. cafer* and *M. c. bengalensis* resembling the former in their sharply defined cap and black ear coverts and approaching the latter in the darker tint of the body plumage and the small area of white on the abdomen. This intermediate position agrees with that of *M. c. pallidus* in the west of the Peninsula; both forms mask the transition of the small southern bird with its sharply defined cap and black ear coverts into the large northern birds with the cap grading into the colour of the back and the ear coverts brown and sharply contrasted. But as these large northern birds obey the general rule and in the north-west are pale (*M. c. intermedius*) and in the north-east dark (*M. c. bengalensis*) the transitional stages are on the west paler than *M. c. cafer* and on the east darker, thereby being sharply contrasted *inter se*.

The eastern intermediate should also bear a name and as none of the names in the Synonomy refer to it we propose the name *M. c. saturatus*.

Type. V. 1424 ♀ 22–2–1930 Anantagiri. Deposited in British Museum.

We recognise the following Indian races :—

Molpastes cafer cafer (Linn.)

Turdus cafer Linnæus, Syst. Nat. xii ed., vol. i (1766), p. 295—Cape of Good Hope, (*errore*), Ceylon.

Small dark race ; cap sharply defined ; ear coverts black.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
23♂	17–20	90·5–98·5	74–89 5	21–23 mm.
7 ♀	17–19·5	88–93	74·5–79	19·5 22 mm.

Ceylon northwards to about Bombay on the west, Nagpur in the centre and Godavery valley on the east.

Molpastes cafer saturatus Kinnear and Whistler. subsp. nov.

Darker than *M. c. cafer* ; less white on abdomen ; cap sharply defined ; ear coverts black.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
4♂	18–19·5	89-97·5	79·89	21–22 mm.
3♀	17–18	84·5–93	75–83	22 ,,

R. Godavery north to Maunbhum, extending probably into parts of the Central Provinces.

Molpastes cafer pallidus Stuart Baker.

M. hæmorrhous pallida Stuart Baker, Bull. B.O.C., xxxviii, p. 15, 1917 (Dec.)—Deesa.

Larger and paler than *M. c. cafer* with broader greyish white fringes to the feathers ; cap sharply defined ; ear coverts black tinged with brown.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
9 ♂	19–21	94–101	82·5–95	22–25 mm.
8 ♀	17·5–19·5	87·5–95	78·5–89	21–23 ,,

Ahmednagar and Khandesh through eastern Sindh and Rajputana to the foot of the Salt Range, the central and southern Punjab.

Molpastes cafer intermedius (Blyth).

Pycnonotus intermedius Blyth, J.A.S.B., vol. xv (1846), p. 50—Upper Provinces[1] Largest and palest race ; cap not sharply defined but grading into the mantle ; ear coverts brown.

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[1] NOTE.—This name is based on a MS. name of Lord A. Hay's : See Jerdon, B. of I, vol. ii., p. 95 which seems to imply that the specimen came from Wazirabad, to which place the type locality may well be restricted.

Largest and palest race ; cap not sharply defined but grading into the mantle ; ear-coverts brown.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
15♂	19·5–22	100·5–110	93·5–103·5	23–26 mm.
10♀	18·5–20	90·5–102	84–96	22-25 mm.

N.-W.F.P., Trans-Salt range plateau, Sub-Himalayan ranges to Naini Tal to the western United Provinces.

Molpastes cafer bengalensis (Blyth).

Pycnonotus bengalensis Blyth, J.A.S.B., vol. xiv, 1845 (after August), p. 566—Bengal.

Large and very dark race ; cap not sharply defined but grading into mantle and lower back ; ear-coverts dark chocolate brown.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
11 ♂	21–23	101·5–106	90·5–99	23·5–25 5 mm.
6 ♀	19–22	89·5–102	85–93	24–25 mm.

Himalayan foot hills from Nepal to Assam ; eastern United Provinces, Bihar and eastern Bengal.

It is impossible to define the ranges of *intermedius* and *bengalensis* very accurately in the United Provinces as they intergrade into each other, whilst there is apparently an area of general intergrading of the races in Central India and the Central Provinces, from which very few specimens are available.

Otocompsa[1] jocosa fuscicaudata Gould.

Otocompsa fuscicaudata Gould, P.Z.S., 1865, p. 664—Madras Presidency ; now restricted to Nilgiris.

Specimens collected :—70, 72, 73 ♀♂♂ 17-4-29, 152 ♂ 29-4-29 Kurumbapatti ; 209 ♂ 12-5-29, 223 ♂ 14-5-29, 244 ♂ 17-5-29, 253 ♂ 20-5-29 Shevaroy Hills 3,400–4,500 ft. ; 409 ♂ 14-6-29 Chitteri range 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
8 ♂	16·5–19	84·5–90	80–85	20–23 mm.
1 ♀	17	83	80	21 ,,

It is unfortunate that by an oversight the *New Fauna* cites ' Madras ' instead of the ' Madras Presidency ' for the type locality of this Red-whiskered Bulbul. The latter is correct both in Gould's reference and in fact, for about Madras city the form which occurs is *Otocampsa j. emeria*. To prevent a recurrence of this mistake we now restrict the type locality to the Nilgiris where it is certainly one of the most abundant birds.

On the eastern side of the Presidency there is no record of *fuscicaudata* north of the Shevaroys and the Chitteri range where it was common at and above 3,000 ft. It is curious that although a small series was collected at Kurumbapatti by La Personne he did not meet with it again anywhere below 3,000 ft. and we have traced no record of it southwards between Salem District and Rameswaram Island (Hume, S.F., iv. p. 458) or westwards until the Palnis and Nilgiris are reached. In the western side of the Presidency, in contrast, it is probably the most common and generally distributed of all birds, occurring from sea-level up to 6,000 ft.

This race is very catholic in its breeding arrangements. Odd nests may be found in any month of the year and some pairs certainly raise two or three broods in succession. Along the Western coast the main breeding season is chiefly from February till May, with a continuation into June and July. In the Nilgiris the main season is from February to June, and again in September after the South-West monsoon. In the Nelliampathis and Travancore the birds are said to start even earlier, in November and December.

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[1] We agree with Sclater (Ibis, 1930, p. 678) in not accepting the change (*New Fauna*, viii, p. 614) from *Otocompsa* to *Elathea*.

The range of this race is really very imperfectly known. It certainly continues common along the Western coast as far as Khandesh and we presume that the birds of the Central Provinces recorded as *fuscicaudata* at Pachmarhi (McMaster, J.B.N.H.S. xxviii, p. 454), as *jocosa* at Chikalda (McMaster, J.A.S.B., 1871, p. 212) and as *fuscicaudata* at Balaghat (D'Abreu, J.B.N.H.S., xxi, p. 1165) are correctly attributed to it. In Rajputana, however, there is a very distinct pale race which we have already separated as *O. j. abuensis* (Bull. B.O.C., ccclv, p. 40).

Otocompsa jocosa emeria (Linnæus).

Motacilla emeria Linnæus, Syst. Nat. x, ed. (1758), vol. i, p. 187—Bengal.

Specimens collected :—553 ♀ 18-7-29, 582 ♂ 22-7-29 Gingee; 628 ♂ 28-7-29, 629 ♀ 27-7-29 Madras ; 667 ♀ juv. 8-8-29, 673 [♂] 10-8-29, 702 ♀ 15-8-29 Palkonda Hills 1,000 ft. ; 1324 ♂ 5-2-30, 1380 ♀ 12-2-30, 1388-9 ♂ ♀ 14-2-30, 1420-1 ♀ ♂ 21-2-30, 1436 ♂ 23-2-30 Anantagiri 3,000 ft. ; 1727, 1728A ♀ ♂ 24-4-30 Jeypore Agency 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
8 ♂	17–18·5	80–88	75–84	18–20·5 mm.
7 ♀	15·5–18·5	78–83·5	72–79	18·5–20·5 mm.

The distribution of this race of Red-whiskered Bulbul in the Presidency is not yet fully known. Beyond Jerdon's statement that it is tolerably common in Goomsoor and the Northern Circars we can only say with certainty that the Survey found it extremely common throughout the hill tracts of Vizagapatam, keeping to the wooded parts and not descending below 2,500 ft. Here they breed in the Lantana scrub which of late years has invaded these areas. The Survey also found it common in the Palkonda Hills but rare on the Seshachalam range.

Specimens collected at Madras and Gingee also belong to this race which here attains its southern limit. It is noteworthy that the Survey specimens from this southern area Palkonda–Madras show very little passage with *fuscicaudata*. At most they are only very slightly smaller with the white tail tips perhaps a trifle diminished. True intermediates do not appear to exist.

Throughout its whole range the Bengal Red-whiskered Bulbul breeds from early March to late September but most birds lay from April to June and after July nests are rare.

We do not feel at all sure that the Red-whiskered Bulbuls of the Duars of the Eastern Himalayas can be kept with this race. They appear to be both larger and more richly coloured but on the material available we do not feel justified in separating them, more especially in view of the paucity of information as to the distribution of this bird in Bengal territories.

Otocompsa flaviventris flaviventris (Tikell).

Vanga flaviventris Tickell, J. A. S. B., vol. ii, 1833 (after Nov.), p. 573 Dampara in Dholbhum.

Specimens collected :—1407 ♂ 18-2-30, 1759 ♂ 3-5-30, 1767 ♀ 4-5-30 Anantagiri 3,000 ft. ; 1717 ♂ 23-4-30 Jeypore agency 2,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	15-16	90–92	84–88	15·5–17 mm.
1 ♀	14–5	84	81	16·5 mm.

These specimens constitute the only records of the Black-crested Yellow Bulbul for the Madras Presidency and a slight extension of the distribution in Chota Nagpur where it is known to occur in Dholbhum and Singhbhum (Tickell), Kalahandi and Orissa S. of the Mahanadi (Ball) and Kutri, Daspalla, also S. of the Mahanadi (Walton).

Iole icterica (Strickland).

Criniger? ictericus Strickland, Ann. Mag. Nat. Hist., vol., xiii (1844), p. 411—East Indies ?—Mahableshwar.

Strickland in his description stated that he believed the bird to have been brought from the East Indies, but that he did not know the precise habitat.

In the catalogue of the Strickland Collection, p. 98, the specimen is given as '*a*' (Askew) 1839.' The type locality has since been given by Stuart-Baker Handlist, p. 43, as Mahableshwar and we accordingly so restrict it.

The distribution of the Yellow-browed Bulbul lies to the west of the Presidency, out of the path of the Survey.

In Travancore it is confined to the hill forests, occurring according to Ferguson from the foot of the hills to 2,000 ft. in the south, above this in Pirmade and the Cardamum Hills and still higher in the High Range. In the Palnis it occurs from 3,000 ft. upwards. In the Nelliampathis it is extremely common.

In the Nilgiris it is found from the foot of the hills upto about 6,500 ft. (W. Davison)[1] but is not found on the plateau. It extends through the Wynaad and the Brahmagiris to Coorg where it is still common. From here it extends further north out of our boundaries up to Mahableshwar.

Throughout its range from Ceylon to Mahableshwar no races can be defined of this species.

Pycnonotus xantholaemus (Jerdon).

Brachypus xantholæmus Jerdon, Madras Jour. Lit. Sci., xiii, 1844 (after November), p. 122—Eastern Ghats west of Nellore.

Specimen collected :—358 ♂ 7-6-29 Chettiri range 2,000 ft.

Measurements :—

Bill.	Wing.	Tail.	Tarsus.
17·5	90 :	86	20 mm.

We are unable to trace the records on which the *New Fauna* states that the Yellow-throated Bulbul occurs in Mysore and Travancore. The only recorded localities for this little-known species are the following :—

1. Bellary :—About twenty pairs observed in June 1901 and c/2 incubated eggs found on June 23 (Col. C. L. Wilson, J. B. N. H. S., XVIII, p. 907).

2. Horsleykonda :—Not uncommon in May 1908 and c/3 eggs found on May 15 and c/2 eggs on May 20 (Roscoe Allen, J. B. N. H. S., xviii, p. 905). A specimen, now in the British Museum, obtained with its eggs in May 1904 by the Rev. H. H. Campbell. This is probably the locality in 'The Eastern ghats west of Nellore' where Jerdon obtained his type specimen.

3. Chettiri range 2,000 ft.—As above. This was the only specimen obtained but La Personne is under the impression that he overlooked others, confusing them with *P. luteolus*.

4. Sankaridrug, Salem District :—A specimen obtained on September 14 1902 by D. G. Hatchell is now in the Society's Collection.

5. Anamallai Hills :—One obtained by William Davison, the only one seen in two weeks, at 4,020 ft. almost as far north as 10° N. and considerably to the west (Ibis., 1886, p. 146).

6. Three more specimens in the British Museum and one in the Indian Museum are labelled 'Madras' or 'Eastern ghats' without precise localities.

The iris is said by Roscoe Allen to be brown and not bright red as recorded.

Pycnonotus gularis (Gould).

Brachypus gularis Gould, P. Z. S., 1835 (after November), p. 186—Travancore.

In Gould's original description the type locality is given as 'in India orientale apud Travancore', the wider sense of East Indies of course being the correct translation.

The Ruby-throated Bulbul has a very limited distribution in western India from N. Kanara southwards. Within the Presidency it is found in Coorg (Betts, J.B.N.H.S., xxxiii, 544) and in the Wynaad (Davison S. F., x. 384), in both of which areas it is by no means common. In the Nilgiris, Betts only met with them at the foot of the hills in the Ochterloney Valley (J.B.N.H.S., xxxiv, 1028). There are specimens in the British Museum from 'Malabar Coast' and Calicut. One was seen in the Nelliampathis by Kinloch on 24th 'near the top of the northern slopes (J. B. N. H. S., xxviii, 280). A female obtained by W. Daly on Mt. Stewart in the Anamallais is in the Indian Museum. Fairbank obtained a single specimen at Vengayam Parry in 1867 in the Palnis, but was never able to meet the bird there again (S. F. v, 405). In Travancore according to Ferguson (J. B. N. H. S., xv, 264) it is not common but he found it in open forest at the foot of the hills and also in thick forest about 2,000 ft , while he mentions the Ghat road to Pirmade as the best locality for it.

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[1] According to Betts (J. B. N. H. S., xxxiv, 1027) it does not occur above about 4,500 ft.

Pycnonotus luteolus luteolus (Lesson).

Hæmatornis luteolus Lesson, Revue Zool., December 1840 (January 1841), p. 354—India, Bombay.

Specimens collected :—11 ♀ Imm. 10-4-29, 79 ♀ 18-4-29, 165 ♀ 1-5-29 Kurumbapatti; 278 ♂ 24-5-29 Shevaroy Hills 4,000 ft.; 342 ♂ Imm. 6-6-29, 362 juv. 8-6-29 Chitteri range 2,000 ft.; 501 ♂ Imm. 4-7-29 Kalai, Trichinopoly; 543 ♂ 17-7-29; ♀ Imm. 19-7-29 Gingee; 699 ♀ 703 ♀ imm. 16-8-29 Palkonda Hills 1,000 ft.; 860 [♀] Imm. 1-10-29 Seshachalam Hills 2,000 ft.; 1031 ♂ 25-11-29 Nallamallai Hills 2,000 ft.

Measurements.—

	Bill.	Wing.	Tail.	Tarsus.
5 ♂	18–20	86·5–90·5	75–85	21·5–22·5
7 ♀	18–19	82–85·5	74–82	20·5–22·5

Although no specimens were procured by the Survey north of the Nallamalais the White-browed Bulbul, which is common in Orissa in a broad zone described by Ball (S. F., iv. 235, v, 417), is found in Goomsoor and throughout the Northern Circars according to Jerdon. From thence it extends all down the eastern side of the Presidency, certainly as far as Trichinopoly. In the central Carnatic, that is from Madras to Salem it is excessively abundant occurring in every patch of jungle and every hedgerow. To use La Personne's expressive phrase, there is hardly a patch of 10 square yards without a White-browed Bulbul in it, generally in the heart of the bushes. It occurs from sea level up to 4,000 ft.

In the west of the Presidency it is less abundant, the more humid hills of this area being apparently an obstacle to it. It does not ascend the Palnis though it is common at their east base. In Travancore Ferguson only obtained two specimens, in the low country near Cottayam in August 1893 (J. B. N. H. S., xv, 264), and there is another from Trivandrum in the British Museum, obtained by Bourdillon on November 16, 1878. North of this I have only records from Coimbatore (Jerdon), Malappuram (Sparrow Collection), Coonoor (Wardlaw-Ramsay) and Wynaad (Hume S.F., x. 384) and it is evidently scarce in this neighbourhood.

There is no information on record about the breeding season in most parts of India. Betham found 2 clutches of eggs in June at Baroda (J.B.N.H.S., xi, 316) and D'Abreu states that it breeds in June at Kamptee. About Bombay it breeds during the rains in July and August (Barnes), April to July (Stuart Baker) and one egg September 14 (E. H. Aitken).

We can detect no variation in the wide range of this species in India but agree with Stuart Baker (*new Fauna* i, 417) that birds from Ceylon are smaller. We measure a series from India as follows :—

	Bill.	Wing.	Tail.
16 ♂	18–20·5	85–91	75–85 mm.
8 ♀	18–20	82–85·5	74–82 ,,

Whereas 7 birds from Ceylon (sexing indifferent but both sexes included) measure :—

Bill.	Wing.	Tail.
18–19·5	77·5–84	68–76·5

They are also slightly darker than Indian birds. We are of opinion that this island race should be recognised and propose for it the name.

Pycnonotus luteolus insulae subsp. nov.

Type ♀ 8-4-28 Tellula, Ceylon (W. P. Lowe). British Museum Reg. No. 1928. 6. 25. 46.

Microtarsus poioicephalus (Jerdon).

Brachypus priocephalus Jerdon, Madras Jour. Lit. Sci. vol. x 1839 (after October), p. 246—Peria Pass, Malabar.

The above spelling was corrected by the author to *poioicephalus* (Ill. Ind. Orni. pl. xxxi). Stuart Baker is in error in giving the type locality as Travancore. Jerdon says clearly 'I only once procured this species of Bulbul in forest at foot of the Persia pass leading from Malabar to Wynaad.' Persia is evidently a misprint for Peria.

This is another Bulbul with a very limited distribution along the south-western side of India from Belgaum to Travancore, where it is a bird of deep and swampy jungles.

In Coorg the Grey-headed Bulbul is common (Betts, J.B.N.H.S., xxxiii, 544). In the Wynaad it is fairly generally distributed and in some localities not uncommon, such as Manantoddy and the Peria forests. In the Nilgiris it is generally overlooked though William Davison procured a specimen near Coonoor (S.F., x. 384) and Cardew found it not rare on some of the slopes about 4,000 ft. (J.B.N.H.S., x, 147). In Malabar Jerdon gives Honore as a locality and there is a specimen from Cannanore in the British Museum.

In Travancore it occurs about 2,000 ft. and Ferguson remarks that he only met with it in one locality in the plains, Kuttyani, an exceptional place where the old forest was still standing. The locality 'Anjango' on the specimen in the British Museum is doubted by Ferguson who remarks it is applied loosely to specimens procured by the professional native skin collectors of that place on their trips to the hills.

Salpornis spilonotus spilonotus (Franklin).

Certhia spilonota Franklin P.Z.S., 1830–31 (1831, Oct. 25), p. 121—Between Calcutta and Benares and in the Vindhyan Hills between the latter place and Guru Mundela.

The Spotted Grey Creeper is not a bird of alluvial plains and is more likely to have been obtained in the second part of Franklin's trip. We therefore restrict the type locality to the Vindhyan Hills.

We can find no authority for the statement (Baker and Inglis, p. 31), that this bird 'occurs rarely on the extreme north-west of Madras.'

If the records are collated and plotted on a map it will be found that the mystery with which most writers surround this species is quite unnecessary. It has already been divided into two races by Meinertzhagen (Bull. B.O C., xlvi, 1926, p. 83). *S. s. rajputanæ* is confined to the Aravallis and adjacent jungles from Mt. Aboo up to Gurgaon. The typical race is far more widely spread. Hume stated (S.F., iii. 462) that it occurs in the Sub-Himalayan forests. This is correct but we know very little about the species in this area. Adams says (S.F., i, 375) that he shot two from a party of six at Moteepur village, Baraitch District in 1868. Hodgson had two specimens taken by himself or his collectors in the Terai of Behar and one of these is still in the British Museum as well as a specimen collected at Gonda by Pinwel.

The typical race also occurs across the centre of the Peninsula from the Narbudda to Chota Nagpur extending southwards to Ahmednagar on the west and Sironcha and the great forests of the Pranhita in the east. In these forests and in the Satpuras it certainly cannot be regarded as rare.

(*To be continued.*)

OLD DECCAN DAYS[1].
MY TIGER-HUNTING JOURNAL IN 1899.

BY

BRIGADIER-GENERAL R. G. BURTON.

On March 18, 1899, having two months' leave, I left Jalna, travelling in a truck on the Hyderabad-Godavery Railway, then under construction, and next day reached Warora, the terminus of the railway that now runs through the Chanda District. I was joined en route by my brother E. B. B., and we drove on to Chanda in small carts drawn by trotting bullocks. Next morning we rode eighteen miles to Chandur, in the Nizam's Dominions beyond the Wardha river. It was in the neighbouring villages that the man-eating panther described in Vol. IX of the Journal by the late Mr. Inverarity, a fine sportsman, had committed its depredations five years before. Our camp, which had been sent on ahead, was pitched on the bank of a considerable watercourse which, with its tributaries, drained the range of mountains running East and West, the watershed sloping northward to the Wardha and on the south to the Godavery. The mountains just above the camp culminated in a peak crowned by the great fort of Manikgarh, hoary with age and at one time bristling with guns, but now abandoned to the wild beasts. To the south stretched for many miles a tumbled mass of jungle-clad hills, largely uninhabited but in the valleys containing one or two considerable towns, such as Jangaon, as well as innumerable hamlets inhabited by aboriginal Gonds who formerly peopled the whole of this part of India.

In the afternoon I tramped out seven miles up the main nullah to Kosambi. Water and cover were plentiful. I found tracks of a tiger and two tigresses, and with dry grass took the measurements of their pugs for purposes of identification, in order to ascertain the numbers of the tiger population. I picketed a number of heilas (young buffaloes) and got back to camp at dusk, very footsore, having covered well over 15 miles. Next day there was no kill and we picketed out more heilas. In the afternoon we went out towards the hills and saw a sambar stag, but did not get a shot. We were following the sambar when a herd of spotted deer appeared and saw us as we crouched. They were all hinds ; they came walking out of the jungle towards us, the leader barking at intervals, and all approaching within about thirty yards. When we moved on they followed, barking, for some time. Some gazelle were also seen.

Again next day there was no kill. There was so much jungle that it was difficult to locate animals ; but we tied up more heilas, making 11 in all. Next morning, March 24, three had been killed by different tigers. The nearest was by Manoli, about two miles from camp; the next a mile and a half farther on up the main nullah, and the third seven miles off at Kosambi. We beat in succession from the first. Soon after the beat began I saw a tiger come up behind trees in E.'s direction, but he suddenly turned back, and soon afterwards he roared and E. saw him galloping across open ground 200 yards off. I thought he had gone, but the uproar of the beaters on that side turned him back, and he came trotting up the nullah straight towards me, looking very angry. I dropped him close by with a broken back and finished him off with a couple more bullets. Soon afterwards a spotted stag galloped along the bank of the nullah 60 yards to my left, where I shot it dead; it dropped from the bank into a pool of water, where both its antlers fell off. This was curious for they should not be ready for casting but should be just mature. We went on to beat the next place, and late in the beat a tigress walked out of the jungle in front of me, and stood broadside on in the open for some time 40 yards off; then she dashed forward between us with a roar; E. rolled her over with a shot in the neck, and I finished her with one between the shoulders. It was now too late to go on to Kosambi, and we returned to camp.

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[1] The first article appeared in vol. xxxiii, No. 1, p. 26.

Next morning we took beaters and started for Kosambi at 7 o'clock. Here was a fine bamboo jungle with plenty of water and dense cover. The tigress was roused with difficulty. Then she roared on the left of the beat where she tried to break up hill but was turned by a Gond with volleys of abuse and much whacking on his tree with a stick. Soon afterwards she walked slowly out and turned her flank to me about fifty yards off, and I shot her dead with a bullet through the shoulder. She broke some of her teeth, biting the rock close by in her dying agony. She was a young tigress, fat and in good condition. Next morning, thinking we had killed all the local tigers, we beat a hill above the camp, posting ourselves on the crest and a bear was hounded from his lair and added to the bag when he broke cover near E. In the evening we were just going out to shoot a peacock for the pot, when a Brinjara came to say that a tiger had killed a cow lower down the nullah near Dhamangaon. It was getting late, but we hurried to the place and got into trees over the kill, which had not been eaten. We sat about an hour after the moon rose, and then returned to the tent. In the morning I sent the camp on 12 miles to Sondo, and went to look at the kill. The tiger had returned to feed during the night, and had torn out an unborn calf which lay beside the remains of the cow. Jackals and crows were at work on the kill, so the tiger, a very large one from the pugs, was not close by. I tracked him to a pool where he had drunk water and turned back. I ringed the whole cover, and found no marks of egress, so we beat the place, but found no tiger. We left him for future operations and rode off to Sondo, 15 miles or more, having lost our way in an extensive forest. The measurements of this tiger's pugs corresponded with those of the tiger first killed. I shot him on the return journey.

There used to be bison here, but they had all died from foot and mouth disease. The camping ground under tamarind trees swarmed with ticks. The country was bare and waterless. Next morning a kill was found about half a mile from camp in bamboo jungle where all the grass had been burnt. The beat was empty. Tigers were in the habit of lying up among the rocks that formed the chief feature of the ground, but the tigress had gone off up the bank of the watercourse; we followed for some distance, and decided that it would be best to sit up over the kill as it was a moonlight night. E. sat up, but the beast did not come back. The country here not being very promising, I sent the shikaris on to Ghat Jangaon, two marches to the south, and on the 30th we marched 15 miles to Bimbara.

Shortly after leaving Lakarkot (two huts and a good well in the jungle) we entered a mountain pass about a mile long. Here very heavy rain came on, and it poured for hours. We got soaked and arrived at Bimbara in a bedraggled condition, and put up in a house kindly placed at our disposal by the Gond Raja Sakharam. The village is a good-sized Raj-Gond one, better built than most. We undressed and wrapped ourselves in blankets, and dried our clothes at fires lighted in the house. Three carts got in at 7, having started at 12 o'clock. The camels could not get through the pass; one slipped and fell down the precipice and was killed, and the other was lost. Carts were sent from Lakarkot and Bimbara, and the kit was brought in; the missing camel was found next morning. We left Bimbara at 9 in the morning, having had every assistance from the Raja and his people.

We passed through Wakri, where a tiger was reported to be in the vicinity, and rode on eight miles to Ghat Jangaon. Here there were said to be several tigers not long since, but much rain had fallen, reports were not satisfactory, and we found only old tracks of one tiger. In the afternoon we went out across the river which held running water, on the banks were numerous peafowl and junglefowl. In the jungle on the far side we put up two sambar stags, but did not see them; also a chital stag which I missed with a running shot. Next day we rode on to Jangaon, where I had camped and shot three or four tigers two years before; and where the camp was joined by a good shikari, Mir Sahib, whom I knew.

I went to picket heilas at Samela, a few miles off, and E. went out and shot two gazelle. There was no kill next day, and I tied up more heilas as far as Paharibanda. Much of the cover in the neighbourhood had been cut down since my last visit. On April 3, there was a kill in Gadranghat near Samela, where I shot a very big tiger in 1897. The cover was extensive and the beat difficult to arrange. The beat had gone on for some time, and many peafowl had come out, when a tigress broke from the cover in front of me and was crossing the river, coming in my direction when a foolish stop on my left began knocking on his tree, and turned the beast across the stream again. Fortunately she was turned back by the stops on the other side, and came out to E. He shot her through the body, and she disappeared in the cover. I knew there was a pair, and in about ten minutes the tiger came out and took the same line as the tigress. Exactly the same thing happened; the same stop turned him, but he was driven back again, and E. shot him; he disappeared in the same bushes as the tigress. I got down from the bank on which I was posted, and we walked up the tigers and found them both dead. After the beat two Gonds came up from Paharibanda and reported that a heila had been killed by a tiger during the morning. This was six or seven miles off.

We beat the Paharibanda cover at noon next day. I had killed a tiger here in 1897. Now a tiger soon came out to E., who knocked it over. It got up, spun round and round, and I fired a shot that broke a hind leg ; I was about seventy yards off. It then scrambled up a big ant-hill at the foot of a tree in which E. was sitting only twelve feet from the ground, and the tiger was consequently now quite close to him. It tried to get at him, and might have pulled him down but for the broken leg. It seized the small charpoy, generally used as a machan, but on this occasion left on the ground below, and jumping about with it, bit and clawed it, growling angrily. However E., who had some difficulty in reloading, put in another shot, and the tiger died with the charpoy in its jaws.

Next day we sent the camp on some miles to the south, to Burjum, where there were tracks of a tiger all along the road. It had lain down not far from one of my heilas during the night, but had not killed, perhaps because the heila had not betrayed its presence by any movement. The shikaris declared that this was due to 'jadu', a spell having been cast over it, and they changed it for another. This was wild country, with very dense jungle and plentiful water ; there were many chital, and a herd of bison was said to be in the neighbourhood. There was a kill on April 7. But the location of the tiger was misunderstood and the beat badly arranged in consequence, guns and stops being too close to the kill. The tiger, which had been lying in a pool of water, was disturbed and went off with a rush and a roar before we were ready to begin the beat, and we could not find him. He killed again that night, but had left the carcass and gone off to a distance.

On April 9, I sent my men to Balanpur, and we marched 14 miles on the way, to Waodam, and next day 9 miles on to Balanpur. We caught some small fish in a pool in the stream with fly. There were tigers about here, where I killed three tigers on a previous visit, but the rain had dispersed them and there were no fresh tracks. On the 11th there was a heavy thunderstorm ; these storms came on every evening, and rain was falling in the mountains. This made it difficult to mark tigers down. They wandered over the hills, whereas if the season had been normal, they would doubtless have remained in the river beds, where cover and water were plentiful. The weather was quite cool, as it had been since we left Sondo. On the evening of 13th the moon was visible at fitful intervals through the massed clouds ; in the far distance flashes of lightning proclaimed thunderstorms in several directions, but no rain fell in camp.

Next morning a kill had taken place at Mohar, and we rode out to the big banyan tree there. A new village was in course of construction. The kill was a mile off on the left of the road. A tigress came out early in the beat, going towards E., so I did not shoot it ; then another came along the bank of the nullah opposite to me, and I dropped it dead in its tracks, about 80 yards off. A third tiger came and turned down into the nullah below me. I shot it through the back, and it charged straight up the bank on the top of which I was sitting; roaring fiercely, it was some fifteen yards off when I rolled it over with a bullet that went in at the neck and came out under the skin of the rump. The first animal had gone off past E. without giving him a shot, as it kept in cover. These were two almost full-grown cubs, a tiger and a tigress; the mother had escaped. After the beat heavy rain fell, the sky clouded over, and lightning was flashing among the distant hills.

A panther prowled round the camp at night, disturbing us with its grating cry. That night there was a kill in a branch nullah to the south, opposite the great banyan tree. The buffalo was heard bellowing and the attacking tiger roaring during the night. The jungle was very thick bamboo, and the beat was arranged with difficulty, as we had to beat an extensive hill side. Two tigers soon made their appearance; they came across my front some distance off, seen at intervals through the bamboos, and were turned by a stop towards E., who was out of sight on the bank of the main nullah. The tigress galloped past him, and he could not get a clear shot and missed her. The report turned the tiger back; he crossed fifty yards in front of me, executing a kind of gambado, jumping about and roaring; I shot him through the shoulder, and he dashed back towards the beaters. I stopped the beat by whistle signal and walked after him, and found him dead against a clump of bamboos. This made a bag of nine tigers in three weeks, a good average. But for the rain we would probably have got the last three sooner.

Next day there were two kills, one in the bed of the main nullah by yesterday's tigress; and one in the place where I shot the two, no doubt by the one that escaped. We beat the former cover first. The tigress sat still in very thick jungle until the beaters came close up, and then broke back with a rush and a roar through the middle of the crowd. It was fortunate that none were killed. She was evidently angry after yesterday's fracas. We then beat the other place, but the beast was wary and had left during the night. Next day we sent the shikaris on 30 miles to Utnur, where I shot three tigers in 1897, and at midday I walked a long way over the hills. About a mile from camp I put up a large sambar stag which was lying in the grass among some trees, and shot him as he ran. He had short but massive antlers.

Having collected 24 men to carry the baggage, we left Balanpur at 6 a.m. on April 15 and climbed the ghaut to Kakarbardi in about two hours. Here we were met by carts, on which we loaded the baggage and then marched on 14 miles to Usegaon. The carts got in at 4 o'clock, having been delayed in changing bullocks at every village en route. We marched by a mountain path next morning and reached Utnur at 9 a.m. Tigers had dispersed after the heavy rain, and only old marks were to be found. There were here three fine lakes, on the largest of which were a lot of whistling and cotton teal, and I also saw a pack of common teal. The Shampur nullah, where I shot two tigers on my last visit, had been cleared of jungle and spoilt. The village of Shampur was deserted. In the evening we shot some teal; the sky then grew inky black, and there was thunder and lightning in the surrounding mountains. At nine rain began to fall and a steady downpour continued for some hours. The Gond Raja, an old friend, and his son called this day, and we returned his visit. He lived in a small house built amid the ruins of the old fort, where his ancestors who once ruled the country had resided for many generations. They had made the great dam which held in the water that formed the big lake, and giant banyan trees, the growth of centuries, were now growing all along it.

Green grass growing a foot or more in height everywhere showed that much rain had fallen. I was told that before the rain bison came nightly to feed in the rice-fields below the bund of the lake but they were not now coming as there was plenty of grazing in the jungle. We walked out through some fifteen miles of forest to the south to look for bison; there was said to be a herd and a solitary bull, but we found only old tracks and the jungle seemed to be singularly destitute of game. We saw only a chital hind. It rained nearly all night, just like monsoon weather, most unusual at this season. However next morning there was a kill in the Durgapet nullah, but the tigress went out through the stops, and was viewed only a couple of hundred yards off, going fast, tail in air. That night a tremendous thunderstorm came on and flooded us out of our tents. We moved into some deserted Hindu temples, of which there were three, one built on granite columns, an excellent residence. In front was a mosque in which my sepoys took up their abode. The oldest inhabitant said that this also was once a Hindu temple, but the Muhammadans had taken a cow and cut its throat there and so desecrated the whole group of buildings. However, the two creeds seemed now to be at peace, and the Raja's 'prime minister' was a Mussalman. In a thicket close by I found the remains of a calf killed by a panther which, I was told, had gone into a hut at Pangri a few miles off where a woman, a child, and a dog were sleeping alongside each other. The beast seized the child and dragged it some distance before being driven off. There were tigers about, and one was heard roaring on the 22nd, but they wandered far in this cool weather when there was water everywhere. We fished several times in the lakes, and caught a number of small fish of various kinds. One might spend a very pleasant month at this place, fishing and shooting, especially if one had a boat. There were large murrell and piran in the lakes as well as many crocodiles, and there must be plenty of wildfowl in the cold weather. One night a heila was killed by wild dogs in the Durgapet nullah. We left Utnur on April 25, went up the mountains and marched 28 miles to Dhobia, arriving at 9-30 p.m. Next morning we went on to Ara, about 20 miles. There was no village between the Gond hamlet of Dhobia and Kolari near Ara. The whole country along the river between Ara and Nagalgunta was deserted. It contained some fine jungle, but these great uninhabited forests are not good for tigers, nor can beaters be obtained. There was, however, some good ground near Dhobia, and the nullah running down from that place to Keri Meri contained several tigers. On the road beyond Dhobia we saw tracks of a tigress and cubs which had passed by in the night. And farther on the way we found marks of a tiger and a tigress and old tracks of a bull bison.

It was scorching hot on the way to Ara, where we arrived at three o'clock, but the baggage did not come in until seven.

The road down the mountains below Dhobia was very bad, difficult for both carts and horses. Rain had fallen everywhere ; the ground was carpeted with long green grass, and nearly all the trees had burst into foliage, giving the jungle the aspect it wears during the rainy season, and all most unfavourable for the purposes of the expedition. Next morning we went a long round and picketed heilas in many good-looking spots. A cow had been killed a mile from camp, but we saw from tracks that it was a panther's kill. A villager said there was a pool of water in the hills. I went a few miles to the head of a deep ravine and found four-day-old marks of a big tiger which had drunk at the pool and had lain down in the grass close by. I tied up a heila. The jungle was very dense and mostly bamboo, and all green after the heavy rainfall. On April 29, it was cool and cloudy.

We discovered a wild Gond living with his two wives and children in the jungle near Kolari. A rupee and a tot of whisky were administered to and appreciated by him. This Kanha was a veritable wild man of the woods. He told me there were some bison in the neighbourhood, and one solitary bull which he saw attacked by a tiger who got the bull by the throat but was flung off and put to flight. He said that this tiger attended him when he was out hunting, and that whenever he shot anything the tiger came straight to the sound of the gun in order to try and get the game he killed.

On April 30, I got up at 4-30 and walked three miles to Kolari where Kanha the wild Gond met me. Some miles farther on we turned in towards the hills, at the foot of which were many tracks of bison, including the solitary bull, but none less than three days old, We climbed the hills and went along the top for some miles but saw only four hornless sambar; one was lame, and apparently had a broken leg, which Kanha said was the result of one of his shots. There was very dense and extensive jungle at the foot of the hills, and the bison may have been in this, but Kanha declared they had been frightened off the ground to a distant jungle by a tigress whose tracks I saw on the road below. On reaching camp at midday, I found news had come in from Samela, near Jangaon, where I had a picket posted, that there had been a kill in the night. We started at 12-30 and rode ten miles to Samela. The kill was half a mile up the nullah from the place where we shot the two tigers on April 10, and where I killed a very fine tiger two years before. This latter had splashed through the water and climbed the bank at my feet about ten yards off, and rushed into dense cover when shot through the body. Following on spots of blood I found it dead about a hundred yards on, stretched across a small nullah.

We now arranged a beat down the main nullah, E. being posted in the best spot where he had an extensive view. The tiger came within a hundred yards of him and then turned up the bank. Fortunately I had placed here my syce, a very reliable stop, who just broke a stick, the crack of which was enough to turn the tiger down again. It then stopped some time in long grass in front of E. until the beaters approached, when it came on and he shot it. He was at the bottom of the nullah in a tree, and the smoke hung so that the tiger could not be seen lying dead for some time, until the air cleared. This was one of the few occasions on which I have known inconvenience caused by using black powder. We both shot with Holland ·500 Express rifles, taking five drams of powder and a 440-grain bullet. The cover was very thick after the heavy rain. It was in this nullah, I was told by Mir Sahib, that Colonel Ludlow, late Inspector-General of the Nizam's Police, had a shikari killed some years before. The colonel had knocked over the tiger and told no one to go near it, as it was still alive. A Rohilla went up to it and was fearfully mauled and died the same night.

On the way back we found tracks of a tiger on the road two miles from camp. The day was very hot, and the weather showed signs of improving, the wind having changed. The tiger we had shot this day was old and thin; he had no fat, and his jaw was furnished with long yellow fangs, one of which was broken. At night when lying awake I heard peafowl calling; probably a tiger was on the prowl. In the morning I was taken very ill, perhaps from eating fish caught in the nullah. There was a kill near Indani, in a watercourse running from the north, by the big tiger of Ara. The beat was an easy one, and the tiger should have been killed without difficulty. But after the stops had been posted, one of the shikaris, who often made mistakes, went too close to the bank of the watercourse and disturbed the tiger, which went off at once. That night the same tiger was prowling, and I could follow his track by listening to the call of the peafowl taken up in one cover after another. There were three kills, one in the hills, one ten miles off at Samela, and one in the Nisani nullah, seven miles off, by the Ara tiger.

We rode off to Samela, where the kill was close to the scene of the last tiger's death. But we beat all the neighbouring cover in vain. I heard a peafowl call at one point, and the tiger must have sneaked off to some distant cover. I had got to Samela with difficulty, having a bad attack of fever, which necessitated a halt of an hour on the way. Next morning, May 3, we started at 9 o'clock to beat up the Ara tiger at Nisani. I had a terrible attack of fever on the way, but was supported on my horse by two men, and on arrival sat on the steep bank of a wide nullah, while E. and the shikaris arranged the beat. Soon after the beat began a fine tiger came through the bamboos behind me; he had tried to break out, but had been turned by Rajaram sepoy, and now, panting heavily, trotted close past where I sat hidden by a clump of bamboos, and rushed down the steep bank below; I knocked him over with a bullet that broke his back, and finished him with another shot. This was one of the best I have killed; he was very heavy and powerful, with a great ruff round his head, 9 feet 4 inches in length. My measurements were always taken between upright pegs at the nose and tail, and the longest tiger I killed in the Deccan was 9 feet 8 inches long, including 3 feet of tail; but the biggest skull of those killed this season belonged to the 9-foot tiger shot on April 30.

It is a curious circumstance that the fever had passed off by the time this beat was over, and I was able to ride six miles to look for the tiger which had killed a heila in the hills. The beat was very difficult in extensive and intricate jungle and almost impracticable ground; the tigress went out to one side, and was not seen. Another kill took place at Samela next day, but this was by the tiger we had already hunted more than once, and he did not stay in the cover, so we went ten miles and back to no purpose; I then withdrew my picket from Jangaon. On the 6th we sent the shikaris on to Sondo on the return journey, and in the evening went out up the Ara river, where we saw only spotted deer and peafowl. This was one of the most beautiful watercourses I have seen, having great forest trees on either side, the deep stream flowing between banks clad with bamboos and carpeted with verdure.

Next morning we started at 4–30. Rain was again falling; we marched 14 miles to Bimbara, and on May 8 to Sondo. Here there were no signs of tigers, and we moved camp next day to Chandur. The Lakarkot pass, where our camel fell and was killed as already related, was again flooded, and on the way to Chandur we were drenched during a tremendous thunderstorm. There was a kill by a panther in the main nullah, and my shikaris saw a pack of about 30 wild dogs in full pursuit of the panther which they had driven from its kill. They had apparently denuded the jungle of game. In the evening I saw a wild dog and pup at the remains of the kill, and made a bad miss; the dog gave vent to a cry when fired at.

On the morning of the 11th we walked eight miles up the nullah. One of our heilas had been killed by wild dogs, but there were no tracks of tigers. However, there was a kill beyond Kosambi, at the head of the nullah, on the 13th. In the beat the tiger soon put in an appearance, his presence being announced by the swearing of monkeys in the trees. He tried to break out to my right, and was only turned back after a great deal of noise by sepoy Rajaram and other stops in the trees, in front of whom he remained quite five minutes roaring fiercely at intervals. At length Rajaram threw his shoes at the tiger, which galloped out grunting angrily, straight towards me. I shot him through the head and he plunged forward sprawling for five yards, when a shot in the neck finished him. He was a fine old tiger with a light-coloured coat, nine feet three inches long. I cut off his head, which now hangs in my hall. This finished the expedition. On May 17, I was back at Jalna, where I was at once laid up for sixteen days with fever. In those days I took no mosquito curtains in to camp. It was generally supposed that mosquitoes sucked the fever out of one instead of pumping it in!

The bag of twelve tigers was not a bad one. But nine were killed in the first three weeks, and none between April 15 and 30. The unseasonable rains no doubt interfered with sport, making the jungle spring up green and dense, and filling all the waterholes, thus inducing all game to wander, and making it difficult to mark down tigers. With normal weather the bag should no doubt have amounted to eighteen or twenty, and, as it was, two or three tigers which should have been shot were lost by bad luck or bad management.

There is a certain amount of sameness in an account of an expedition of this nature. But it gives some idea of the sport to be met with in those jungles south of the Wardha river which it was never my fortune to visit again. It may be gathered that sport can only be assured by hard work, and by constant vigilance; and even then one is much at the mercy of stops and beaters. Stops sometimes lose their heads, or misunderstand their directions, however thoroughly these may have been impressed upon them. But when all is said, the sportsman is greatly indebted to these poor men who, for a mere pittance, cheerfully and willingly undertake the great labour of beating in wild and intricate jungle, unarmed and in considerable danger from the wild beasts which they drive from their lairs. And now, more than thirty years after, I recall them and my shikaris and other followers with grateful remembrance and admiration.

THE BLACK AND BROWN BEARS OF EUROPE AND ASIA.

BY

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PART I.

(*With 11 text-figures.*)

EUROPEAN AND ASIATIC REPRESENTATIVES OF THE BROWN BEAR.
(*Ursus arctos.*)

INTRODUCTION.

The Structural characters of Bears.

The Bears or *Ursidæ* are a well-defined family of the Carnivora and are generally so well known that only a brief introductory notice of some of their structural characters is required to explain the meaning of some of the terms employed in the description of the genera and species.

They are large or medium-sized, heavily built, comparatively inactive beasts with erect, rounded ears, relatively small eyes and a well-developed area of naked skin, the *rhinarium*, round the nostrils. The rhinarium varies in different kinds of bears; but typically it is like the corresponding organ in the Canidæ (Wolves, Jackals and Foxes), and divides the upper lip by a narrow strip of skin, the *philtrum*. The lips, however, differ from those of the Canidæ, and indeed from those of all other Carnivora, so far as is known, by being loose and protrusible, owing to their edges in front being free from the gum. Also the tactile vibrissæ which are well-developed on the muzzle, above the eyes and on the cheeks in all predatory Carnivora, are short in the Bears or reduced to practically functionless vestiges. The tail is quite short, serving the purpose merely of an anal operculum; and the anal glands, which are important and of large size in most related Carnivora, like the weasels, badgers and dogs, are absent or negligible in size. The external genitalia are like those of the Canidæ, the prepuce being situated far in advance of the scrotum and the penis provided with a long, stout bone. The attitude of pairing is as in the Canidæ; but the operation is not followed by 'tying' as in that family.

I have compared the Bears more particularly with the Dogs because the two families are known from fossil remains to be nearly related and descended from the same stock. But unquestionably the most marked external difference between them lies in the feet. Dogs have short narrow paws with symmetrically paired or 'artiodactyle' digits of which the 3rd and 4th are considerably longer than the 2nd and 5th. In the hind foot the heel is raised high off the ground, the area between it and the main plantar pad is covered with hair and the first digit is undeveloped. In the forefoot the first digit, except in the African Hunting Dog (*Lycaon*), is present but is always small, a functionless vestige in fact and is set some little distance from the second and is never in contact with the ground when the animal is standing or on the move. The dog is naturally a predatory hunter and his feet are fashioned for running and leaping and have short, strong claws which grip the ground. The gait is described as 'digitigrade', the body being supported on the plantar pad and the digital pads of four toes. The feet of the Bears are entirely different. They are short and broad, provided with five subequal digits, the pads of which are disposed in a lightly curved line in front of the wide plantar pad, all of them being in contact with the ground. They are armed with long, powerful, curved claws, used for climbing, digging and fighting, the claws of the forepaw, which are more required for those purposes, being about twice as long as those of the hind paw. When walking on all fours a Bear applies the digital and plantar pads of the forefoot to the ground, just as a Dog does. Usually the heel of the hind foot is slightly raised, but it is so close

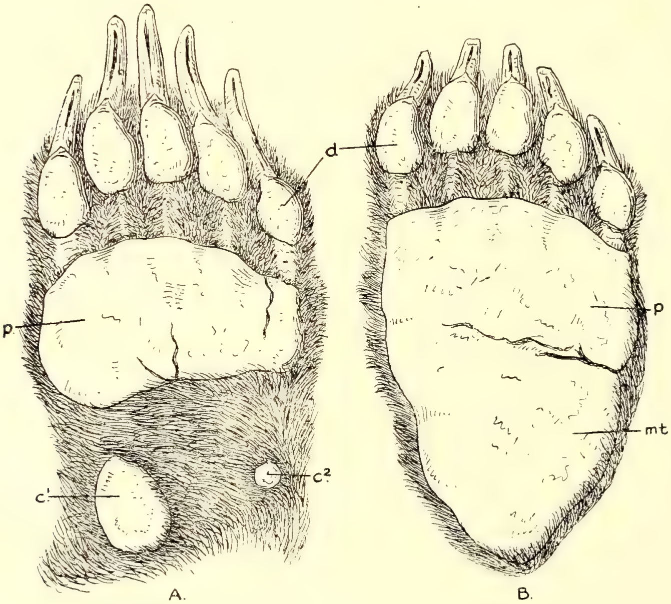

FIG. 1.

A. Underside of right fore foot of young Red Bear (*Ursus arctos isabellinus*); *d* digital pad; *p* plantar pad; c^1 external carpal pad; c^2 internal carpal pad.

B. The same of the hind foot. *d* and *p* as in A; *mt*, metatarsal pad (The hair clipped short to reveal pads.)
The paws of other genera of Bears will be figured in subsequent parts of this paper.

to the ground that the animal looks as if he were walking ' flat-footed '. When clumsily galloping he appears, at times at least, to use the entire sole of the hind foot for propulsion ; and when standing erect in bipedal fashion, an attitude easily assumed on account of the freedom of the knee from the body, the whole sole, back to the heel, is employed for support. For these reasons the gait of a Bear is conventionally described as ' plantigrade '. But that term is somewhat misleading. It is not true of the forefoot and suggests a greater difference than actually exists between the gait of a Bear and of an ordinary digitigrade Carnivore.

The skulls of many youngish bears in dorsal profile are unmistakably like those of dogs, especially domesticated breeds with the cranium vaulted. Structurally the most important difference lies in the external bone of the ear which in the dog has a high, inflated bulla and no appreciable tube to the orifice whereas in the bear the bulla is flat or comparatively slightly inflated and is produced externally in the adult into a long, bony tube with terminal orifice. The teeth, however, of the two animals are profoundly different. Numerically they are the same above and below, the dental formula on each side being $i\frac{3}{3}$, $c\frac{1}{1}$, $pm\frac{4}{4}$, $m\frac{2}{3}$. The incisors (*i*) and canines (*c*) require no special notice ; but the premolars (*pm*) and the molars (*m*), together constituting the *cheek-teeth*, are modelled on totally different lines in compliance with the differences in diet of the animals. The Canidæ are predatory flesh-eaters, with typically carnivorous dentition, the fourth premolar above and the first molar below, called the 'carnassials ', being the largest teeth of the jaws, set far back at the ' point of greatest mechanical efficiency ' and provided with high, compressed, blade-like cusps. The premolars in front of the carnassials, except the first which is small, are tolerably large teeth with compressed sharply-cusped, cutting crowns. The two molars above and below at the back of the jaw are smaller than the carnassials especially in the lower jaw, and comparatively flat crowned, the last of the lower jaw being practically functionless, while that of the upper jaw, although larger and functional, is much smaller than the first molar which precedes it.

The cheek-teeth of the Bears, on the other hand, are essentially adapted for the mastication of hard or fibrous vegetable substances, like roots, grasses, nuts and fruits, although the diet consists also to a great extent of soft fruits, honey, insects and flesh. None of the teeth has cutting blades, and the ' carnassials ' are not differentiated either by size or function. The fourth upper premolar, corresponding to the enlarged, trenchant carnassial of the dog or wolf, is a comparatively small tooth with two or three blunt cusps and two roots only ; and, as Miller pointed out, differs from that of all other Carnivores, not only in being two-rooted but in being set forwards in the jaw in front of the ante-orbital foramen on the muzzle, well in advance of the ' point of greatest mechanical efficiency.' The first of the three lower molars, representing the lower ' carnassial ' of the wolf, is, however, a large, long, broad tooth, with a low cuspidate crown. This and the two molars behind it and the two molars of the upper jaw opposed to them, all having low, crushing, bluntly cuspidate and tubercular crowns, are conspicuously the largest and principal cheek-teeth, the first three premolars, above and below being small and comparatively functionless, one or more of them

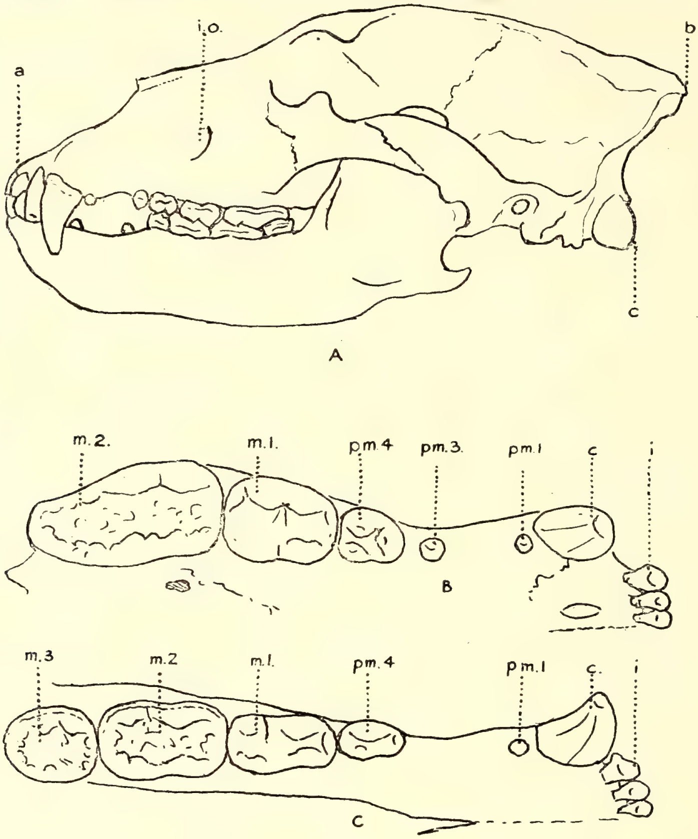

FIG. 2.

A. Side view of skull of European Brown Bear (*Ursus arctos arctos*) *a* to *b* total length ; *a* to *c* condylo-basal length ; *i.o.* infra-orbital foramen.
B. Teeth of right side of upper jaw of Red Bear (*U. a. isabelliuns*). *i* incisors ; *c* canine ; *pm* premolars ; *m* molars.
C. Teeth of left side of lower jaw of the same. Lettering as in B.

being frequently shed before old age supervenes. In the particulars mentioned above, the dentition of the Bears is absolutely distinctive of the family.

In addition to the Bears mentioned in this paper there are only two well-marked existing genera of the family, namely the Polar bear of the arctic and the so-called Spectacled bear (*Tremarctos ornatus*) of South America. Blanford, however, in his volume on *The Mammals of British India* (p. 205) assigns to the Ursidæ a beast, inhabiting Moupin, which he cites as *Æluropus melanoleucus*. This animal, now known as *Ailuropoda melanoleuca*, is the so-called Parti-coloured Bear or Giant Panda. The latter title is decidedly preferable because the animal, although superficially resembling a small bear in size and shape, differs so profoundly in dentition and other structural features that it must be excluded from the family and associated rather with the true Panda, its resemblance to the bears being a case of adaptive convergence.

THE DISTINGUISHING CHARACTERS AND DISTRIBUTION OF THE EUROPEAN AND ASIATIC BLACK AND BROWN BEARS.

In his volume on *The Mammals of British India*, Blanford referred the four species of Bears inhabiting that area to two genera: *Ursus*, comprising the Brown Bear (*U. arctus* or *arctos*), the Himalayan Black Bear (*U. torquatus* or *thibetanus*, as it is now called) and the Malay Bear (*U. malayanus*), and *Melursus*, comprising the Sloth Bear (*M. ursinus*). In this he followed the example of most of his predecessors; and, like them, he attached great importance to the absence of the two median upper incisor teeth in differentiating *Melursus* from *Ursus*. This classification is, however, open to the criticism that the evidence supplied by the skull and forefeet shows

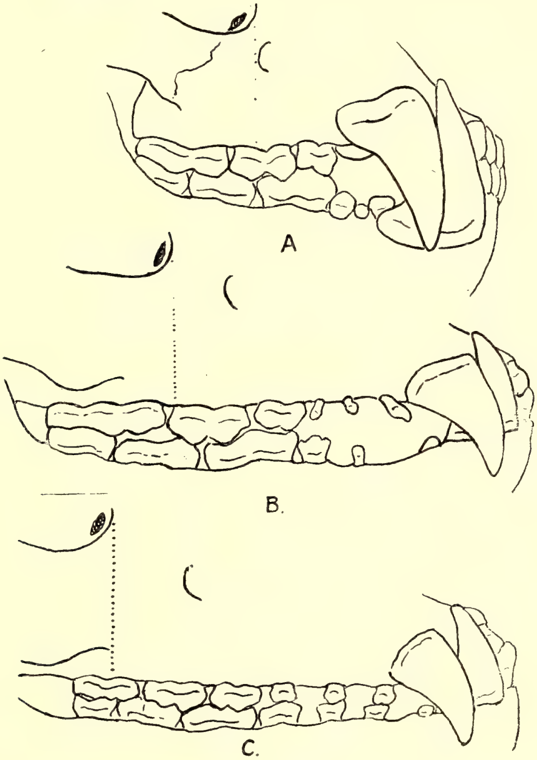

FIG. 3.

A. Jaws of the Malayan Bear (*Helarctos malayanus*) showing the short muzzle and the enormous canines with consequent crowding of the premolars.
B. The same of the Himalayan Black Bear (*Selenarctos thibetanus*) with longer muzzle and nearly complete dentition.
C. The same of the Sloth Bear (*Melursus ursinus*) with still longer muzzle and complete, more primitive dentition. (The dotted line is a tangent from the front edge of the orbit to the upper molar teeth.)

that the kinship between the Sloth Bear (*Melursus ursinus*) and the Brown Bear (*Ursus arctos*) is closer than the kinship between the latter and the Malay Bear (*Ursus malayanus*). Horsfield, indeed, perceiving that the characters of the Malay Bear were of generic importance, had as early as 1824 separated it from *Ursus* as *Helarctos*. These distinctions did not appeal to Blanford; but they are deep-seated; and the genus *Helarctos* is admitted at the present time by every zoologist familiar with the group. The Himalayan Black Bear, as it is somewhat inappropriately called, also receives deserved generic status under the name *Selenarctos*, assigned to it in 1901 by Heude, who distinguished it from *Ursus* by the already known differences between the two in cranial characters. Being unacquainted with Heude's work I proposed the name *Arcticonus* for the same bear in 1917, separating it from *Ursus* by a well-marked difference in the structure of the forepaw which I pointed out in 1914.

Thus each of the four species described in Blanford's volume is the representative of a distinct genus. The distribution of the four genera is interesting. *Ursus* is, or was, found all over Europe, temperate Asia and North America, mostly in forested districts to the south of the area occupied by the Polar Bear (*Thalarctos maritimus*). Along its southern limit in the Old World it just overlaps everywhere the range of *Selenarctos* which extends from Baluchistan through the Himalayas and thence through China and the adjoining continental islands at least as far north as Amurland. To the south of the range of *Selenarctos* occurs *Melursus* in Peninsular India and Ceylon and *Helarctos* in Burma, Siam and thence southwards to Java and Borneo. These two genera are the only Asiatic representatives of the family which are exclusively Oriental in range.

By cranial, dental and external characters the four genera may be readily defined.

The following is an analytical key, based on external features by which properly preserved skins may be at once determined :—

a. Carpal area of the forefoot with a single, cordate external (ulnar) pad and at most a small internal (radial) pad or area of naked skin representing it. Digital pads more closely united, sometimes completely fused.

b. Carpal area thickly overgrown with long hair surrounding the external pad and concealing the internal; area between the digital pads and plantar pad on both feet overgrown with long hair arising typically from four interdigital mats. Rhinarium with philtrum and without valvular nostrils; muzzle hairy to the lips which are only moderately protrusible ... ... *Ursus*.

b^1. Carpal area and the area between the fused digital pads and the plantar pad naked; rhinarium without philtrum and with valvular nostrils; lips almost naked and highly protrusible ... ... *Melursus*.

a^1. Carpal area of forefoot occupied by a single large piriform pad, with ulnar and radial elements obscurely indicated, as wide as the plantar pad and nearly or quite as long externally

c. Ears, as in *Ursus* and *Melursus*, long expanded, basally tubular and mobile and strengthened by vertical cartilaginous ridges; rhinarium and lips nearly as in *Ursus* ... ... *Selenarctos*.

c^1. Ears short, not expanded, not tubular basally, hardly mobile and without vertical cartilaginous ridges ; rhinarium and lips in a measure adaptively foreshadowing those of *Melursus* ... *Helarctos.*

Key to the genera based upon adult skulls :—

a. The whole skull short and broad, its mastoid width equal to the length of the palate + the mesopterygoid fossa, or longer ; tympanic bulla convex, its width with the auditory tube about equal to the length of the upper cheek-teeth ; these teeth short but the canines and incisors relatively very large, the basal length of the upper canine at least as long as the last upper molar ... ... *Helarctos.*

b. Skull longer relatively to its width, its mastoid width seldom exceeding the palate ; tympanic bulla flattened, its width with the auditory tube much less than the area of the upper cheek-teeth ; canines and incisors relatively smaller, basal length of upper canine, except in *Melursus,* less than length of last upper molar.

a^1. Median upper incisors present ; palate flat or only slightly concave between the cheek-teeth, which are comparatively large, so that the length of its postdental portion is much less than that of the last three upper cheek-teeth ; anterior premolars reduced ; last upper molar larger than the first.

c. Jaws short in comparison with the cranium proper; cheek-teeth less strongly cusped and set farther back so that the anterior edge of the last upper molar is not in front of the antero inferior edge of the orbit ... ... *Selenarctos.*

c^1. Jaws longer in comparison with the cranium ; cheek-teeth more strongly cusped and set more forward so that the anterior edge of the last upper molar is in front of the antero-inferior edge of the orbit .. .. *Ursus.*

b^1. Median upper incisors absent ; palate markedly vaulted between the cheek-teeth, which are set forwards and reduced in size, so that the length of the postdental portion of the palate is not less than the length of the last three upper cheek-teeth ; anterior premolars less reduced ; last upper molar subequal to first ... ... *Melursus.*

Note on the Analytical Keys. The key based upon external features has the advantage of applying to cubs as well as to adult and old bears. This is not true of the key based upon cranial features which alter greatly with age and seem to continue to vary throughout the life of the individual. The skulls of cubs of all species are much alike apart from minor differences ; but there is no difficulty in distinguishing the skulls of adults. *Helarctos* and *Melursus* show exceedingly well-marked features ; but *Selenarctos* and *Ursus* are not so sharply defined. As in the structure of the paws, so too in the skull and teeth, *Selenarctos* unmistakably comes nearest to *Helarctos* and *Ursus* to *Melursus.*

Under the headings '*a*' and '*b*' of the second table the proportion between the mastoid width and the median palatal length is used as a character. The difference is best marked in *Helarctos,* where the mastoid width greatly exceeds the palate, and in *Melursus* where it is much less. In *Selenarctos* and *Ursus* the dimensions are on the average tolerably subequal ; but in both genera the mastoid width may surpass the palate. In the case of *Selenarctos* this is due to the shortness of the palate accompanying the shorter jaws of that genus. In the case of *Ursus* it is due to excessive development of the mastoids which occurs sometimes in very old animals.

Genus Ursus, Linn.

Ursus, Linn., *Syst. Nat.*, ed. 10, p. 47, 1758 (in part); Miller, *Cat. Mamm. Western Europe*, p. 285, 1912; Pocock, *Proc. Zool. Soc.*, 1914, p. 940.

Myrmarctos, Gray, *Proc. Zool. Soc.*, 1865, p. 694.

Ursarctos + *Melanarctos*, Heude, *Mém. Soc. Hist. Nat. Chin.*, IV, pt. I, p. 18, 1898.

Mylarctos, Lönnberg, *Proc. Zool. Soc.*, 1923, p. 85.

Spelæus (Goldfüss), Sowerby, *Journ. Mamm.* I, pp. 224–232, 1920

It is needless to repeat here the generic diagnosis of *Ursus* given in the tables printed above.

Notes on the synonymy. In Miller's Catalogue, above quoted, he cited *Myrmarctos* and *Ursarctos* as synonyms of *Ursus* but omitted *Melanarctos* Heude proposed for the black Manchurian bear named *cavifrons.* This is dealt with below under the race of Brown Bear described as *U. arctos lasiotus.* The two last names on the list were

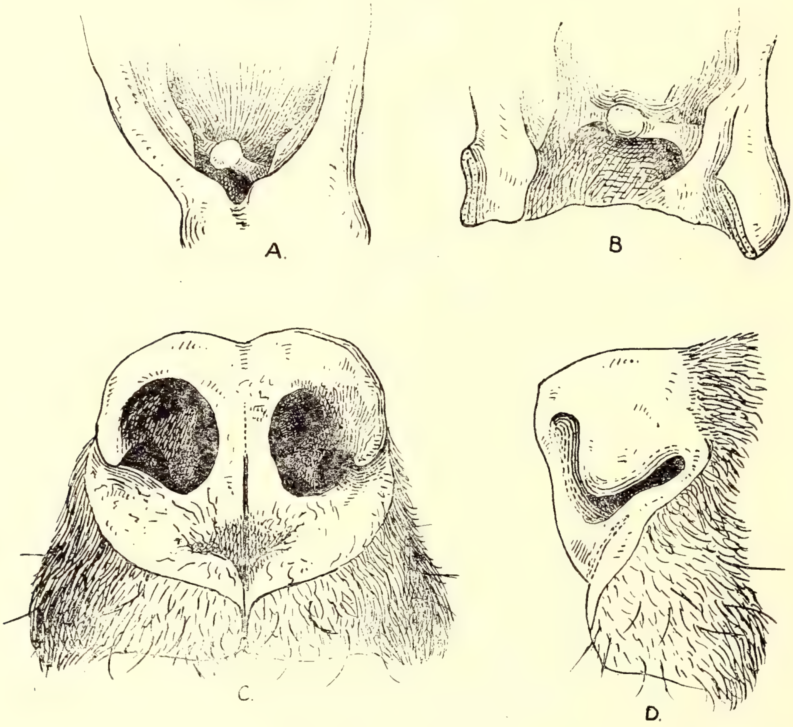

Fig. 4.

A. Base of ear of European Brown Bear (*U. a. arctos*) with hair removed.

B. The same cut open to show the ridger.

C. The rhinarium, or nose, of Grizzly Bear (*U. a. ferox*) from Montana. Front view.

D. The same from the side.

The ear and nose of other genera of bears will be figured in subsequent parts of this paper.

introduced since the publication of the Catalogue and reasons for their dismissal must be given.

Mylarctos was proposed by Lönnberg for *Ursus pruinosus*, Blyth, because he considered it differed from *Ursus*, typified by *arctos*, in the following particulars :—

1. (*a*) The digital pads of both fore and hind feet are fused nearly to their distal ends so that the hairs from the sides of the toes do not project downwards between them.
   (*b*) The hairs between the digital and plantar pads are arranged in four interdigital patches or mats, leaving a smooth, hairless strip of skin passing from the digital pads to the plantar pads.
2. The teeth, especially the molars, are relatively and actually much larger. This is demonstrated by several dimensions taken from the two examples of *pruinosus* available to him for examination and from others recorded by Leche, as compared with dimensions of Swedish bears and of one skull of the Mongolian bear (*lasiotus*).

My reasons for rejecting *Mylarctos* are as follows :—

1. (*a*) An example of *pruinosus*, in the British Museum, from the borders of Tibet and China (*Capt. Neill Malcolm*) has the digital pads separated precisely as in typical *Ursus arctos*.
   (*b*) An example of *Ursus arctos* has the hairs on the space between the digital and plantar pads disposed in patches or mats exactly as described and figured by Lönnberg as distinctive of *Mylarctos*.
2. The skull of an example of *pruinosus*, from N.-E. Lhasa, of approximately the same age as Lönnberg's young specimen from S.-W. Kansu, has relatively and actually much smaller teeth, the last lower molar being visible practically in its entirety in profile view and unconcealed in its posterior portion by the ascending process of the mandible. Moreover, the tables of tooth-measurements published below show complete intergradation in size between the teeth of *pruinosus* and those of other races of *Ursus*, notably *U. arctos lasiotas* and *yesoenssi*.

In 1920 A. de C. Sowerby attempted a revision of the Bears of this group inhabiting Eastern Asia, and admitted 12 'species' referable to 2 genera, *Ursus* and *Spelæus*, distinguished by the shape of the forehead. Unfortunately, the author's acquaintance with Bears and the material at his disposal were alike small. The shape of the skull varies profoundly with age, sex and in adult individuals of both sexes from the same district and as a character is not even of specific value ; and as regards the 12 'species', Sowerby fell into the fundamental fallacy of assuming that Bears from the same locality are alike in colour and cranial features. The coat, in colour and other characters, varies greatly according to the season and to a less extent irrespective of season. These points will be dealt with under the various headings.

DESCRIPTION OF THE RACES OF *Ursus arctos.*

Ursus arctos, Linn.

Ursus arctos, Linn., *Syst. Nat.*, ed. 10, I, p. 47, 1758, and of subsequent authors including Miller, *Cat. Mamm. Western Europe*, pp. 285-297, 1912.

Distribution. Europe, North and Central Asia, N. America.

Following Lydekker, I regard all the bears, generally described as 'browns' and 'grizzlies', inhabiting Europe, Asia and North America, as members of this species, some of the technically described forms representing subspecies or local races.

THE EUROPEAN BROWN BEAR.

Ursus arctos arctos, Linn.

Locality of Type : Sweden.

Distribution : Europe; eastern range into Asia unknown.

In Miller's volume, above quoted, more than a page is devoted to the names given by authors to supposed species, races or varieties of the European Brown Bear. It is needless to repeat all the names with bibliographical references, but the following may be quoted to indicate the seasonal, local or individual variations in colour, which were regarded as of systematic significance. Some of the names, too, were based on differences in skulls, due to age or sex.

Niger, Gmel., N. Europe; *major*, Nilss., S. Scandinavia; *minor*, Nilss., N. Scandinavia; *brunneus*, *annulatus*, *argenteus*, *myrmecophagus* (=*formicarius*), Billb., N. Scandinavia; *norvegicus*, Fisch., *aureus*, Fitz., *eversmanni*, Gray, Norway; *polonicus*, Gray, Poland, *badius*, Schr., Bohemia; *fuscus*, Gmel., *rufus*, Borkh., *alpinus*, Fisch.; Alps; *pyrenaicus*, Fisch., *pyrenæus*, F. Cuv., Asturias, Spain. The bear of Barbary has been named *crowtheri.*

Considering the wide range of this bear from north to south in Europe, it is possible that more than one local race has been developed. But the available material is insufficient to establish this conclusion; and since the species has been killed out in all the settled districts and is apparently very rare even where it still lingers, it is improbable that skins and skulls will ever be procured to demonstrate whether the Barbary, Pyrenean, Alpine or Bohemian brown bears differ from the typical Scandinavian bear or not. Cabrera, however, claimed that the Spanish bear differs from the typical Swedish race in its black legs and the different proportions between the length of the skull and the zygomatic width. (*Fauna Iberica : Mamm.*, p. 152, 1914.) The last-mentioned character, however, is too variable with age to be trusted and the legs are deep brownish black in the skin described below from Lake Ladoga, which from its distribution should be typical *U. a. arctos.*

Comparatively recently, Altobello recorded the brown bear from Abruzzo and Molise in Italy, naming it *Ursus arctos marsicanus*

(*Fauna Abruzzo e Molise ; Mamm.*, p. 15, 1921 ; *Rend. Un. Zool.*, p. 32, fig. 1924 ; *Ann. Ist. Technic.*, pp. 15–16, fig. 16, 1926). He distinguished it from the typical form because a skull of it differed from the unlocalised skull *U. a. arctos*, selected for illustration by Miller, in having a shorter sagittal crest. But this character, being in my opinion, a matter of age or individual development, has no systematic value.

Of European bears referred to the typical race, there are only four in the British Museum.

1. A mounted specimen from Sweden (Earl of Selkirk, 1840), in new winter coat. General colour uniformly pale brown, the tips of the hairs dull buff with a greyish glint in certain lights ; the basal portions of the hairs and the underwool dark brown but this tint only showing when the coat is artificially disarranged. Legs deep brown. No trace of a white collar. Claws black.
   The mounted specimen is 3½ ft. at the shoulder.
2. Flat skin from Bihar, Hungary in new winter coat. General colour uniformly drab brown, the tips of the hairs showing up vividly as whitish buff under reflected light, especially on the head, neck and fore quarters. But on the back the pallid tips of the hairs are less extensive and not so pale, being scarcely in evidence on the shoulder-mat which is the same dark brown hue as the basal parts of the hairs elsewhere. The underwool greyish brown. The head is greyish buff; the legs dark brown and glistening. A patch of wholly white hair on the side of the neck showing trace of a collar. Claws black. The hair on the back is about 3½ inches, on the flanks 4½ and on the mat and neck 5.
3. Skin from the Engadine in old thick and tufted winter coat. General colour very grey, but mottled where the hair is parted by tufting. The basal portion of the hairs darker than in the preceding specimens, almost blackish brown, and more strongly contrasted with the tips which are more extensively pallid and decidedly greyer, apparently bleached. The underwool greyish brown. Legs darker than in preceding specimens, the fore legs almost blackish brown. The ventral surface pale brown, the hairs with grizzled tips. Claws not so black, tinged with pale horn colour.
4. Lake Ladoga (Ivor Montagu, B. M. No. 29-5-24·1). Skin of a subadult female in summer coat, with little, if any, underwool. Head golden brown. General colour greyish brown, mottled where the hair is disarranged showing the dark brown bases of the hairs on the back and the paler brown bases on the flanks, the tint variable with the fall of the light; the rump noticeably reddish brown. No white collar. Legs rich blackish brown.

Skulls. In the following table are given the principal measurements of the skulls in the British Museum, those of the cranium being given in English inches, those of the teeth in millimetres. The legends of the figures of the skull explain the terms applied to the different regions. It may be added that since the total length of the skull depends upon the development of the occipital crest, a muscular ridge subject to variation, the condylo-basal length is a better criterion of size. These remarks apply to all the tables of cranial dimensions published in this paper. Also, it must be explained, the collective measurements of the last 3 upper cheek teeth ($pm^4 + m^1 + m^2$) and of the last 4 lower cheek teeth ($pm_4 + m_1 + m_2 + m_3$) varies in accordance with the curvature of the tooth-row. In two skulls, for instance, in which the teeth are individually of the same length respectively, the series, if straight in one skull, will be a little longer than in another in which it is curved.

	Skull in English inches.[1]						Upper teeth in millim.		Lower teeth in millim.	
Locality and sex	Total length	Cond. bas. length	Zygom. width	Mastoid width	Int. orb. width	Max. width	Last 3 teeth	Last tooth	Last 4 teeth	Penult tooth
Sweden, old ♂	14·8	13·8	9·9	7	3·4	3·2	65	31 × 17	75	22 × 13
Russia, subad ♂	14·5	13·5	7·6	6·2+	3-	...	72	37 × 20	...	25 × 16
Sweden, ad. ♂	13·8	12·9	8·4	6·3	3	3	65	30 × 16	75	23 × 13
,, young (?)♂	...	...	...	...	...	...	71	35 × 17	81	24 × 15
Olonetz, Russia, old ♂	12·7	12·1	8	6·2	3	...	66	30 × 17	75	22 × 13
Norway, young ♂	12·6	11·9	7+	5+	2·8	2·8	...	34 × 19	...	25 × 15
Lake Ladoga, subad ♀	12·1	11·7	6·7	5·1	2·6	2·5	66	31 × 16	75	23 × 13
Norway, ♀	11·8	11	6·3	4·6	2·1+	...	63	29 × 16	68	22 × 12
Engadine, ♀	...	10·2	6·2	4·6	2·4	...	61	29 × 17	68	21 × 12
Transylvania ad. ♀	12·3	11·7	7·4	5·4	...	2·8	69	34 × 16	75	24 × 14
,, ad. ♀	12·1	11·5	6·9	5	2·6	2·8	68	34 × 17	77	23 × 15
,, young	11·9	11·3	6·6	5	2·3	2·5	65	31 × 18	75	23 × 14

[1] The measurements are taken as follows:—Total length from the edge of the muzzle above the incisor teeth to the end of the sagittal crest; condylo-basal length from the same point to the posterior edge of the occipital condyle; zygomatic width across the zygomatic arches; mastoid width across the mastoid processes; inter-orbital width, the narrowest point between the orbits; maxillary width, the width of the muzzle just above the socket of the canine teeth; the last 3 upper and the last 4 lower teeth, their total length as situated in the jaw; the last upper tooth and the penultimate lower tooth, their greatest length and width.

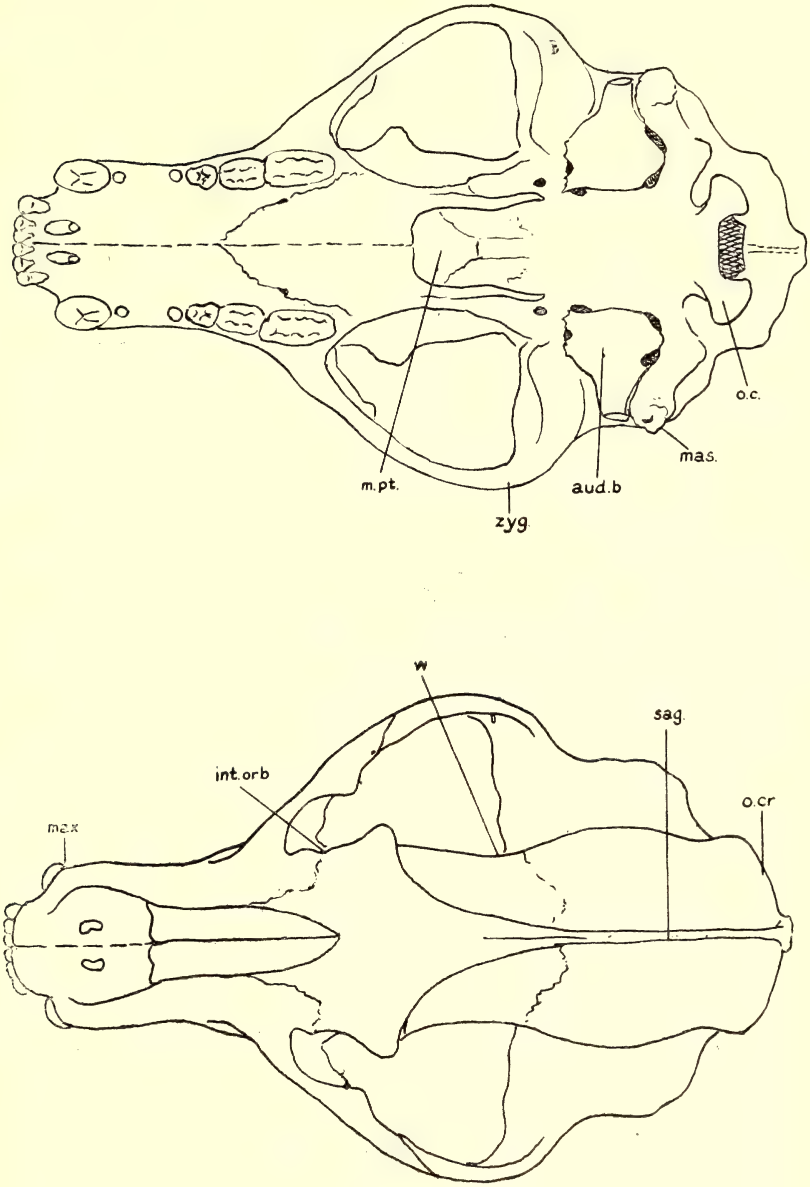

FIG. 5.

Upper fig. Lower view of skull of European Brown Bear (after Miller). *mpt.* mesopterygoid fossa ; *zyg.* zygomatic arch ; and *v* auditory bulla ; *mas.* mastoid process ; *o.c.* occipital condyle.

Lower fig. Upper view of the same. *max.* maxilla; *int. orb.* inter-orbital area ; *w.* waist ; *sag.* sagittal crest ; *o.cs.* oecipifal crest.
(These figures and fig. 2 show the points where measurements are taken.)

The first skull on this list, the largest in the collection of the British Museum, is that of an old male (Earl of Selkirk, No. 218a), with the teeth much worn. Its occipital crest is broken and its recorded total length has been inferred from analogy to be just under 15 ins. It has an unusually flat frontal profile, the brow being in no way inflated by air-cells. The second on the list, a Russian skull, is in the United States National Museum, and was measured by Miller who, however, did not record the total length. This I have inferred from the condylo-basal length. It is evidently a youngish skull as attested by the narrowness of the zygomata and the open basi-occipital suture mentioned by Miller. It would probably have reached or surpassed 15 ins. when full-grown. The longest Swedish skulls measured by Lönnberg (*Proc. Zool. Soc.* pt. 1, p. 94, 1923) were from 14½ to just under 15 ins. I can find no record of a skull of *Ursus arctos* surpassing 15 ins., skulls from 14 to 15 ins. being large. Miller's Russian skull also has exceptionally large, probably unworn, teeth. The total length of the last 3 upper cheek teeth of this skull, recorded in the tables is the sum of the 3 teeth measured separately by Miller. The third skull on the list is that of an adult male from Sweden (Lloyd, No. 62. 3. 29. 7). It is considerably shorter and narrower than the Earl of Selkirk's, but wider than Miller's Russian skull, although not so long, and the teeth are much smaller; but the fourth, a young, probably male, specimen, with the same history (No. 62. 3. 29. 8), has considerably larger teeth, nearly as large as in the Russian skull. The fifth skull from the Province of Olonetz (Lataste Coll., No. 19. 7. 7. 3609), although unsexed and comparatively small, I regard as a male on account of its shape. It is

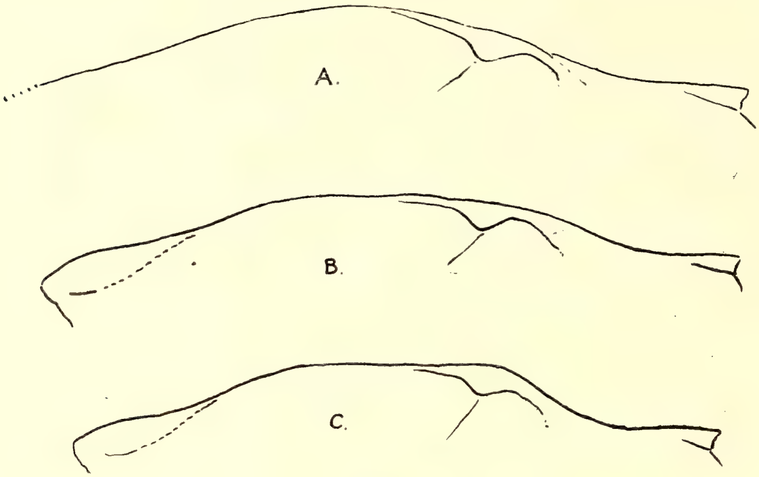

FIG. 6.

Profile variation of the upper surface of the skull of the European Brown Bear.

A. The old male skull from Sweden (Earl of Selkirk).
B. The adult male from Sweden (Lloyd).
C. The adult male from Olonetz, Russia (Lataste).

noticeably 'high-browed' from the inflation of the frontals between the post-orbital processes, with a marked concavity at the base of the muzzle. It differs most strikingly in this particular and in size from the Earl of Selkirk's Swedish skull; but the Swedish skull, No. 3 on the list, is almost exactly intermediate between the two in both these particulars. The sixth skull from Telemarken, Norway, preserved in the Royal College of Surgeons Museum, is not mature, the cranial sutures being unfused and the teeth, which are large, unworn.

The skulls of adult females I have seen are smaller, between 12 and 12½ ins. long, and narrower everywhere. They also show no inflation of the frontals and may be described as low-browed, the dorsal profile sloping tolerably evenly from the highest point near the middle of the crown to the end of the muzzle. The teeth, however, are approximately as large as in the males. I have seen no quite adult female skulls from Scandinavia; but there is one very nearly full-grown from Lake Ladoga in Russia (Ivor Montagu, No. 29. 5. 24·1). A series of three from Transylvania does not differ from it in any way suggesting that they may represent a distinct local race.

From an examination of these and other skulls in the British Museum I can find no reasons for the adoption, as indicating subspecies, of any of the names that have been proposed for the European bears. The individual variation in the size and shape of the cranium and of the teeth in specimens from the same or nearly adjoining districts is very striking and shows the untrustworthiness of the characters that have been used by systematists for the differentiation of the European bears into species and local races.[1]

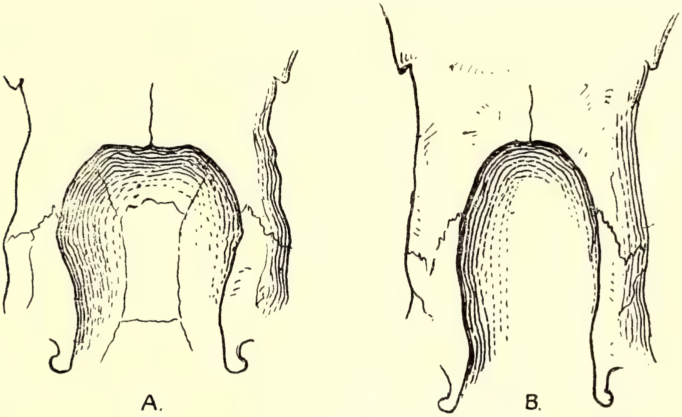

FIG. 7.
Variation in the shape of the mesopterygoid fossa in the European Brown Bear.
A. A youngish specimen from Bihar, Hungary.
B. An adult specimen from Transylvania.

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[1] Examination of the skulls of the bears of the *Ursus arctos* group enumerated in this paper from Europe and Asia forces me to reject, without hesitation, the conclusion that the closely related bears, 'grizzlies' and others, of North America are divisible into all the host of species and subspecies that have been established on cranial and dental characters.

Other characters are also subject to variation. As an instance I may cite the mesopterygoid fossa which may be either long and narrow or short and wide, as shown in the subjoined sketch of this region in skulls from Hungary and Transylvania, districts too near and too similar in physical features to permit, in my opinion, the conclusion that two different kinds of bears are concerned.

In conclusion I may repeat that the material in the British Museum completely corroborates the statements of Miller and Lönnberg regarding the variability of the skulls of the typical European race of *Ursus arctos*. Lönnberg, indeed, criticising Sowerby's views on this point, wrote:—'We have . . . from the same tract of southern Lapland skulls with a straight profile and others with the profile just as concave as Heude's figure of *cavifrons*.'

THE SYRIAN BEAR.

Ursus arctos syriacus, Hempr. and Ehrenb.

Ursus syriacus, Hemprich and Ehrenberg, *Symb. Phys.* I (unpaged) pl. 1, 1828. Quoted by most subsequent authors but apparently not accurately known to them.
Ursus schmitzi, Matschie, *SB. Ges. Nat. Fr. Berlin*, 1917, p. 33.

Locality of type of *syriacus*: near the village of Bischerre, Mt. Makmel, Lebanon.
,, ,, ,, *schmitzi*: Mt. Hermon.

Hemprich and Ehrenberg described this bear as smaller than *U. arctos arctos* and paler in colour. The typical specimen, killed in July with the moult in progress, measured 3 ft. 8 ins. and was not full-grown. Its colour was uniformly yellowish or greyish-white, the tips of the hairs being white and their basal portions mostly yellowish or pallid buff, but some of the hairs all white; the coat mottled with 'fulvous' owing to the basal portions of the hairs and the very scanty underwool of that tint being displayed by the shedding of the dead white tips in patches or by their disarrangement. Near the claws the hairs greyish or 'palely fuscous'. The claws varied with white and grey bands, those of the forepaw 1·9 ins. long, of the hind paw 1·3 ins. The naked skin of the nose and lips greyish flesh-coloured, not black. Hairs generally shortish, 4 ins. on the shoulder-mat, 2 to 3 ins. elsewhere.

Hemprich and Ehrenberg saw other skins of this bear and said its colour may be all 'fulvous' or sometimes almost brown.

Ursus schmitzi, Matschie, was described as a 'species' distinct from *syriacus* because of certain supposed but, in any case valueless differences in colour; and since Mt. Hermon is only a short distance to the south of Mt. Lebanon, there are not, in my opinion, any good reasons for considering that *schmitzi* is even racially distinct from *syriacus*.

A number of names have been given, principally by Russian authors, to so-called races of bears from the Caucasus and Transcaucasia. These were based partly upon colour, partly upon cranial variations and size of teeth. The results reached are hopelessly at variance and, in my opinion, eminently unsound; but owing to the scanty material at my disposal I am unable to disentangle the confusion. The only contribution to the question I can make is an epitome of the conclusions with my reasons for dissenting from them resting upon such information as I possess regarding bears' skulls in general and upon the material at my disposal from Caucasia, Asia Minor and Syria in particular

Ursus arctos var. *meridionalis*, Middendorff, *Verhandl. Russ. Kais Mineral. Gesellschaft.* 1851, p. 80.

The name *meridionalis* was apparently used by Middendorff originally as a comprehensive title for three southern brown bears, *pyrenaicus*, *syriacus* and *isabellinus;* but since he expressly mentioned the Caucasus as its locality, probably because he had a skull or skulls from that part of Russia, and since subsequent authors have restricted the name to Caucasian bears, I see no reason to interfere with that application of it.

Middendorff regarded this bear as distinct from the European variety, which he called *normalis*, because the smallest skulls of it are one-twelfth shorter than those of the typical form. He was concerned with cranial characters only and gave no information about the colour of *meridionalis.*

Radde (*Fauna und Flora des Caspi-Gebietes*, p. 6, 1886) wrote of *meridionalis* as occurring not only in the district of Talysch on the south-west coast of the Caspian but generally throughout Transcaucasia. The colour is almost entirely pale, varying from light dirty yellowish grey to fawn and reddish grey-brown, intergrading more or less with that of *syriacus.* In size the bears vary considerably.

It is important to note that Radde definitely applied the name *meridionalis* to the pale bear of Transcaucasia which approaches *syriacus.* Since he was apparently the first author to describe the colour of this race, I abide by his decision.

Further evidence of the generally light hue of Caucasian bears was supplied by Grevé (*Nov. Act. Acad. Leop.* 63, p. 225, 1895), who wrote of pale specimens from that region exhibited in the Zoological Gardens, Moscow. This author, like some of his predecessors and successors, seems to have thought that two species of the Brown Bear may live separate lives, without interbreeding, in the same district. At all events he assigned the bears of Europe and northern Asia to one 'brown' species *Ursus arctos*, including *meridionalis* from the Caucasus; and the bears of south-western Asia to another 'Grey' species *Ursus syriacus*, which inhabits the Caucasus, Transcaucasia, Asia Minor, Palestine and Mount Elburz and Shiraz in Persia. But in view of Radde's earlier application of *meridionalis* to the pale Caucasian bear, Grevé's ascription of it to the 'brown' bear cannot be entertained.

Amongst the synonyms of *syriacus* Grevé cited '*caucasicus* Schrank [Schrenck]', a name which seems to have no status. He said that Gray regarded Middendorff's *meridionalis* and Schrank's (*sic*) *caucasicus* as races of *arctos*. Gray, it is true, admitted *meridionalis* as a 'subvariety' of *arctos* (*Proc. Zool. Soc.* 1864, p. 662; *Cat. Carn. Brit. Mus.*, p. 220, 1867); but he did not mention *caucasicus*. Trouessart, misled apparently by Grevé, also quoted '*caucasicus*, Schrenck' (*Cat. Mam*, I, p. 241, 1897); but he gave no bibliographical reference to it. I too have failed to trace it in Schrenck's essay on Asiatic bears (*Reise Amurland*, I; *Säug*., p. 7, 1858.)

As will be shown below, the name *caucasicus* was later resuscitated by Smirnov without reference to its previous introduction by Grevé.

Between 1896 and 1914 Satunin discussed the bears of the Caucasian area with various changes of opinion. His first record was the occurrence of three races, namely typical *Ursus arctos*, *U. arctos meridionalis* and *U. arctos syriacus*. He gave the name *meridionalis* to 'very pale coloured' bears of Transcaucasia; but apparently included *syriacus* on the authority of Hemprich and Ehrenberg, whose diagnosis he abridged, giving its distribution as Transcaucasia from the Black to the Caspian Seas (*Zool. Jahrb.* Syst. 9, p. 292, 1896). Subsequently he united these two under the name *meridionalis* which he described as 'for the most part very pale', and excluded *syriacus* from the Transcaucasian fauna (*Mitth. Kauk. Mus.*, 2, p. 287, 1905). Later in the same volume (p. 374) he wrote: 'the dark Transkaukasian and Persian bears I consider to be *meridionalis*.' This change in the application of the name *meridionalis* was, in my opinion, quite unjustifiable in view of Radde's ascription of the name *meridionalis* to the pale Transcaucasian bear, as mentioned above.

Satunin's next move in 1913 was to introduce the name *lasistanicus* for the pale Transcaucasian bears (see *Mitth. Kauk. Mus.*, 8, p. 5, 1914). And in his last paper (*Conspect. Mamm. Imp. Ross.* 1914, pp. 93–94), the two names *meridionalis* and *lasistanicus* appear to symbolise the bears of this district of Asia. But *lasistanicus* falls as a synonym of *meridionalis* as defined by Radde.

The truth no doubt is that Caucasia is a transitional zone, so far at least as the colour of its bears is concerned, between typical *U. arctos arctos* and *U. a. syriacus*. Some years ago the Zoological Gardens received from a donor, who brought them from the 'Caucasus', two young bears of the same age and size and very likely cubs of the same litter. One was darkish brown and indistinguishable from living specimens I have seen from northern Russia; the other was pale tawny like so-called 'Syrian' bears.

Satunin's conclusions were based upon a study of skins. His successor, Smirnov (*Bull. Mus. Cauc.*, 12, pp. 109–133, 1919), worked at the skulls with the result that he came to different conclusions and increased the number of named forms even to the extent of introducing a quadrinominal title to express one case of cranial variation. He admitted the following forms:—

(*a*) *U. arctos arctos*, from western Ciscaucasia.

(*b*) *U. a.* var. *caucasicus*, nov. (= *U. a. meridionalis*, Midd. + *U. a. arctos*, Sat.), from the main chain of the Caucasus and Borjom.

(*c*) *U. a. arctos* natio [*sic*] *dinniki* nov., from Caucasus Minor.

(*d*) *U. a. meridionalis*, Midd., from the median region of south Europe, northern slopes of the main chain of the Caucasus, western and south-eastern Transcaucasia, N. Persia.

(*e*) *U. a. lasistanicus* (= *syriacus*, Sat.), from S.-W. Transcaucasia, where it is most numerous, Lazistan and probably almost everywhere in the habitat of *meridionalis*.

It is needless to reproduce the description of these supposedly distinct forms of bears. They are based almost wholly upon differences in the shapes of the skulls and the size of the teeth. Smirnov fortunately published a series of photographs of the skulls of all of them, except *lasistanicus.* These photographs, although small and obscure, are sufficient to show the main features on which he relied. The evidence that these skulls represent geographical or environmental races amounts, in my opinion, to very little. From what I have seen of the skulls of bears, I should say that they represent stages of development that could be closely paralleled by almost any good series of skulls of *Ursus arctos* from any country, the differences between them being due partly to differences of age, partly to use, greater or less, of the cranial muscles, partly to innate individual variation. The skull assigned to *U. a. arctos* resembles tolerably closely the adult male Swedish skull (Lloyd No. 62.3.29.7) described above, but is very different from the flat-browed Swedish skull presented by Lord Selkirk (No. 218*a*) and from the high-browed skull from Olonetz. The one labelled *dinniki* is like the one labelled *U. a. arctos* but is not quite so hollowed in front of the brows and has a lower sagittal crest. The type skull of *caucasicus*, which is indicated as a new race although the name was published years previously by Grevé, is a massive high-browed skull recalling in shape the skulls from Kamschatka described below under *beringianus* and also the Olonetz skull of *U. a. arctos.* The skull identified as *meridionalis* looks like a young-adult skull which by the development of the sagittal crest and a few more air-cells in its brow would, when mature, have closely resembled the skull of *caucasicus.* The photographs are mostly too obscure to show the degree of fusion of the cranial sutures; but in several cases, the two frontal bones are disunited, a sure sign of incompleteness of development.

Ognev [*Nature and Sport in Ukraine* (transl. of Russian title), pp. 4–5, 1924], who followed Smirnov, still further confused the question by using *dinniki* as a quadrinominal of *U. a. caucasicus* and *lasistanicus* as a quadrinominal of *U. a. meridionalis.*

Ursus arctos smirnovi, Lönnberg (*Särtryck ur Fauna och Flora Populär Tidskrift för Biologi*, pt. I, p. 28, 1925). This name was given to the bear from the northern slopes of the main chain of the Caucasus identified by Smirnov as *meridionalis* and represented by the undeveloped male skull above referred to. As stated above, I do not consider that any systematic importance should be attached to the shape of this skull.

Ursus arctos persicus, Lönnberg (*Särtryck ur Fauna och Flora Populär Tidskr för Biologi*, pt. I, p. 28, 1925). The type and only known example of this alleged race is the skull of a cub, with a highly vaulted, convex crown, from Mazanderan, N. Persia, south of the Caspian. It was described as new on account of the large size of the teeth. The last three upper cheek-teeth ($pm^4 + m^1 + m^2$) measure 73½ mm., the last (m^2) being 37 by 19½ mm.; and the last four lower cheek-teeth ($pm_4 + m_1 + m_2 + m_3$) measure 82 mm. These dimensions, both in the upper and lower jaw, exceeded by 7 mm. the corresponding teeth of a skull of *syriacus* cited by Lönnberg in confirmation of the novelty of *persicus*. But the value of the character is considerably lessened when the teeth of *persicus* are compared with those of the Syrian bears, first and second on my list, printed below, the difference being merely a question of 5½ mm. in the upper jaw and 4 mm. in the lower jaw. The differences, indeed, are less than those between the second and third skulls on my list, both of which are ticketed 'Syria.' My table moreover, of the skulls of European bears shows a difference of 6 mm. in the upper and lower jaws in the two Swedish specimens, the third and fourth on the list; and the table of Kamschatkan skulls, all of about the same age with tolerably similarly worn teeth, shows a difference of 12 mm. in the upper and 11 in the lower teeth. It may also be noticed that the size of the teeth in *persicus* agrees very closely, individually and collectively, with the largest teeth of the European brown bears recorded in my table.

As above stated, the immature skull of *persicus* is highly vaulted. It slopes somewhat steeply backwards to the occiput from its highest point well in front of the parieto-frontal suture and rather abruptly and convexly over the forehead to the base of the muzzle above. In this particular it differs noticeably from the immature skull from the Trebizond district of Asia Minor recorded below. In this skull the dorsal profile has its highest point farther back, approximately coinciding with the parieto-frontal suture. From this point it slopes steeply backwards to the occiput and inclines forwards at a gently sinuous slope, almost uninterrupted in steepness, to the tip of the nasals. This skull, indeed, looks as if it would have grown into the 'low-browed' type, whereas the skull of *persicus* looks to be potentially 'high-browed', like *caucasicus* of Smirnov.

The only skin in the British Museum from S.-W. Asia, is that of a young male from Sumela, 30 miles S. of Trebizond, 1,000–1,300 ft., Oct. 10th (A. Robert, B. M., No. 6.3.6.29). The coat is tolerably thick, with moderately abundant underwool. The general colour of the body, above and below, and of head is whitish grey, but more or less mottled with darker hue when the hair is disturbed. On the shoulder-mat and for a short distance in front and behind it the tips are brownish and here the long hairs are blackish basally; but low down on the flanks the basal portion is brown. The underwood is mostly pale brown, darker along the mid-line of the back. There is no white collar. Muzzle brown, darker than head. Limbs pale brown, becoming darker towards the paws. Claws black, slender and unworn, on forepaw 1·7 in., on hind paw about ¾ in. long. Head and body, measured in the flesh, just over 3½ ft., tail 1½ in. Hair about 3 in. long.

In its generally whitish-grey hue this bear closely resembles Hemprich and Ehrenberg's figure of *syriacus*, but it differs from their description of that race in the dark hue of the basal portion of the hairs, the browner legs and mid-line of the back, the blackish grey claws and the black nose and edges of the lips.

From its whitish-grey colour and its locality just to the south of the eastern end of the Black Sea, I identify this bear as *U. a. meridionalis*, following Radde's application of that name to the pale bears of Transcaucasia which Satunin subsequently called *lasistanicus;* but the evidence that *meridionalis* is racially distinct from *syriacus* is as yet inconclusive.

The following are the principal cranial and dental measurements of the skulls from Syria, Asia Minor and the Caucasus in the British Museum :—

	Skull in English inches.						Upper teeth in millim.		Lower teeth in millim.	
Locality and sex	Total length	Cond. bas. length	Zygom. width	Mast. width	Int. orb. width	Max. width	Last 3 teeth	Last tooth	Last 4 teeth	Penult. tooth
Syria ♂ immat.	13·4	12·4	7·5	6·1	2·6	3. +	68	34 × 18	78	23 × 14
,, ♀ ad.	12·4	11·7	6·8	6·1	2·7	2·5	68	34 × 17	78	24 × 15
,, ♀ ad.	11·4	10·4	6·2	4·9	2·3	2·5	62	30 × 15	72	22 × 14
Smyrna ♀ ad.	12·0	11·2	7·5	5·9	2·7	2·6	65	31 × 17	71	21 × 14
Trebizond ♂ cub.	8·6	8·4	4·9	3·7	2·0	2·0	68	33 × 17	74	23 × 14
Caucasus ♂ immat.	11·4	10·8	6·7	4·9	2·4	2·4 +	65 (or curve)	34 × 17	73	23 × 14
Caucasus, N.Slope ♀ old.	11·6	10·8 +	6·7	5·1	2·7	2·6	64	32 × 17	72	22 × 14

No two of these skulls are alike and none resembles precisely any one of those figured by Smirnov. I can detect, moreover, no character in shape or in cranial and dental measurements distinguishing them collectively from the Swedish, Russian and Transylvanian skulls above referred to *U. arctos arctos.* Brief notes on them, therefore, will suffice. The Syrian specimens (1010 *b* ; 1010 *g*, 60.4.23.4 ; 1010 *a*, 52.3.2.7) came from the Zoological Society ; but there is no proof that they were menagerie-reared. The first appears to be that of a male. It is not full-sized and, allowing for the age-difference, closely resembles the Swedish male skull (Lloyd, 62.3.29.7). Like the rest of the skulls it is low-browed. The other two from Syria, both adult, I take to be females. The third has unusually small teeth, like the skull from the Engadine, but their smallness is not due to wear. The Smyrna skull (H. A. Wittall, No. 2.5.7.1) is fully adult. The fifth on the list, belonging to the skin, above assigned to *meridionalis*, from Sumela, 30 miles S. of Trebizond (No. 6.3.6.29), is quite young. The sixth, collected by St. George Littledale and merely labelled Caucasus, I take to be the skull of a subadult male. It has a highly vaulted cranium very like that of the skull named *persicus* by Lönnberg and recalls skulls of similar age of the Himalayan race *isabellinus* on the one hand and some skulls of the European race on the other. The last on the list came from the north-western slopes of the Caucasus (St. George Littledale, No. 87.12.22.1). It is an oldish female with scarce a trace even of facial sutures and is indistinguishable from female skulls of *U. a. arctos* from Transylvania.

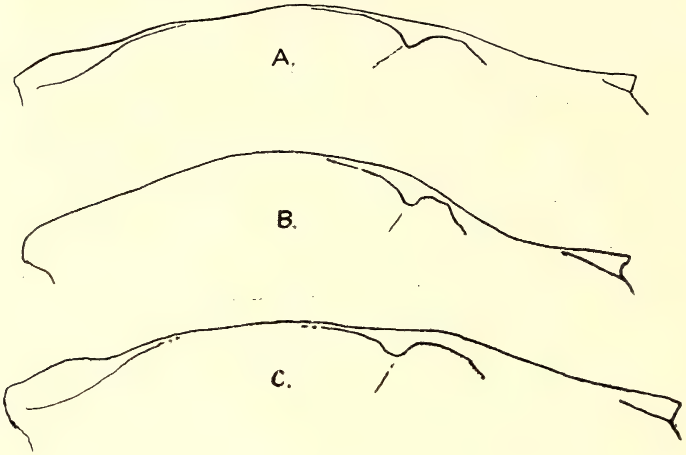

FIG. 8.

Profile variation of the upper surface of the skull of Brown Bears of Asia Minor and the Caucasus.

A. Old female from the north-western slope of the Caucasus (Littledale).
B. Immature, probably male, specimen from the Caucasus (Littledale).
C. Young-adult male from Smyrna.

The Brown Bear of Baluchistan. (*Ursus gedrosianus.*) A bear which for geographical reasons must not be lost sight of in the present connection is *Ursus gedrosianus*, described by Blanford from an imperfect skin secured at Tump, 70 miles north of Gwadar on the Mekran coast, Baluchistan. (*Proc. As. Soc. Bengal*, 1877, p. 204, and *Journ. As. Soc. Bengal*, 46, p. 317, 1877). According to Blanford, the colour of this bear was dark rufous brown, like European examples of *Ursus arctos*, with the shoulders and outer sides of the limbs darker than the back, the muzzle whitish, the tip of the chin white and a white semicircular collar on the breast but not produced in front of the shoulder. The coat was thin, short and harsh, 1½ ins. long on the body and 2½ ins. on the shoulder.

The rest of the story of this bear, of the subsequently received specimens Blanford assigned to it[1], which induced him to relegate the name *gedrosianus* to the synonymy of the Himalayan Black bear (*Selenarctos thibetanus*), on the supposition that he had been deceived into describing it by the 'discoloration' of the skin of the type, will be told fully under the account of that species. It is, however, quite clear from the description of this skin that, with the possible exception of the breast-collar, the characters recorded, e.g. the colour and the presence of the long hair on the shoulder, agree much more closely with those of the Brown bear (*U. arctos*) than of the Himalayan Black bear. Finally I may add that Mr. C. E. Capito, formerly of the Anglo-Persian Oil Co., informed me that he was well acquainted with a small 'brown' bear, like the European animal, frequenting the hills of southern Persia to the north of the Gulf, a habitat very similar to 'the arid districts of the Mekran coast' whence the type of *gedrosianus* came. Blanford candidly admitted that he was quite unable to account for the occurrence of so essentially a woodland species as *thibetanus* in such an unlikely locality.

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[1] Blanford's material of this bear has disappeared. I wrote to the Calcutta Museum to inquire for the skins and skulls but was told they are not there.

Conclusion. So far as I can judge from the material at my disposal and from the accounts published by other authors, the bears of Asia Minor and Syria merely differ from the typical Brown bear of Europe in being on the average paler in colour, intermediate specimens occurring in the Caucasus and perhaps in northern Persia.

THE SIBERIAN BROWN BEAR.

Ursus arctos collaris, Cuv. & Geoffr.

Ursus collaris, Cuvier and Geoffroy St. Hilaire, *Hist. Nat. Mamm.* pt. 42, pl., 1824; *Tabl. Gen.* p. 3, no. 212, 1842.

Ursus arctos var. *sibiricus*, Gray, *Proc. Zool. Soc.* 1864, p. 682; *id. Cat. Carn. Brit. Mus.* 1869, p. 219.

Ursus arctos jeniseensis, Ognev, *Nature and Sport in Ukraine* (transl. of Russian title), p. 4, 1924.

Locality of type of *collaris*: Siberia.
,, ,, *sibiricus* (if any): Siberia.
,, ,, *jeniseensis*: Yenissei Prov., C. Siberia.

Judging from Cuvier's illustration, the type of this bear when figured, was carrying a long and apparently tufted winter coat. The general colour of the head and body is yellowish brown, mottled with darker streaks where the deep-tinted bases of the hairs and underwool are shown. On the neck is a very broad whitish collar which not only passes over the nape in front of the shoulder-mat but apparently extends forwards to the back of the head. There is also a pale stripe on the flank behind the axilla and elbow of the foreleg. The legs are black and sharply contrasted with the brown body.

This bear has sometimes been united with *U. arctos arctos*, sometimes with *U. a. beringianus*, sometimes regarded as a distinct variety. Provisionally, I give it racial status because it differs from all the examples of those two subspecies I have seen or read about in the great extent of the collar on the sides and nape of the neck, associated with black legs.

Its greatest interest perhaps lies in its resemblance to some examples of *pruinosus*. The latter, as explained below, has black legs contrasted with the paler flanks, dark under-hair and frequently a pale area behind the axilla associated with a broad collar which may extend over the nape in front of the withers although never so wide on this area as in *collaris*.

Gray seems to have projected the name *sibiricus* into ursine literature on the strength of his knowledge that the Brown bear occurs in

Siberia. He did not apparently associate it with any definite specimen. Trouessart, wrongly so far as I can ascertain, assigned the name *sibiricus* to F. Cuvier, thinking apparently that that author had so entitled the ' ours de Sibérie ', which, in reality, he named *collaris.* Gray did not assign the name to Cuvier or indicate that he himself was the first to introduce it and all that he said to give the name systematic status was that the bear is ' in all states and ages brown '.

The suggestion made from geographical considerations, that *jeniseensis* may be a synonym of *collaris* is a mere guess on my part. The sub-species was based upon what I consider to be valueless cranial characters, and cannot be compared with *collaris,* the skull of which is unknown.

THE KAMSCHATKAN BROWN BEAR.

Ursus arctos beringianus, Mid.

Ursus arctos var. Geoffroy St. Hilaire, *Zool. Voy.* ' *Venus* ' Atlas, Pl. 4, 184-, text, p. 121, 1855.
Ursus arctos var. *beringiana*, Middendorff, *Sibir. Reise*, II, pt. 2, p. 4, pl. 1, figs. 1–5, 1853.
Ursus piscator, Pucheran, *Rev. Mag. Zool.* 1855, p. 392.
Ursus mandchuricus, Heude, *Hist. Nat. Chin.* 4, pp. 23–24, pl. 17, figs. 1–1^{e} 1898.
Ursus arctos kolymensis, Ognev, *Nature and Sport in Ukraine* (transl. of Russian title), p. 6, 1924.

Locality of type of *beringianus :* Great Shantar Island, Sea of Okhotsk.
,, ,, *piscator* : Petropaulovski, S. Kamschatka.
,, ,, *mandchuricus :* Near Vladivostock in Manchuria.
,, ,, *kolymensis :* Kolyma, N.-W. of Sea of Okhotsk.

Distribution : Manchuria northwards round the Sea of Okhotsk, thence southwards into the Kamschatka Peninsula.

The first recorded example of this bear was a brown cub captured at the southern extremity of Kamschatka, near Petropaulovski, and brought alive to Paris, where it was seen, when 4 years old by G. St. Hilaire and described as ' very dark brown, paler on the muzzle and throat, but deeper even black on the posterior part of the back, the flanks, croup and limbs, the claws also being black and the collar absent.'

Pucheran named this bear *Ursus piscator* without contributing anything fresh to the information regarding it or giving reasons for dissenting from Geoffroy's view that it was a mere variety of the common European Brown Bear.

Middendorff gave the name *beringiana* to two skulls, one of a very old male from Great Shantar Island, the other of an apparently adult female from the adjoining mainland of Uda Bay, on the Okhotsk Sea, in Amurland.

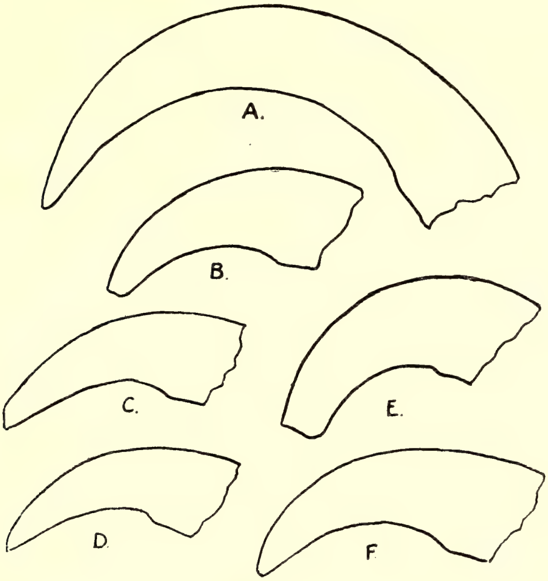

FIG. 9.

Claw of forepaw of exampler of the Brown Bear (*Ursus arctos*), referred to in the text.

A. Of the type of *U. a. shanorum*. Captive specimen.
B. Of a typical Brown Bear (*U. a. arctos*) from Lake Ladoga.
C. Of a Red Bear (*U. a. isabellinus*) from Gilgit.
D. Of a Tibetan Blue or Snow Bear (*U. a. pruinosus*) from Kansu.
E. Of the type of a Manchurian Black Bear (*U. a. lasiotus*) Captive specimen.
F. Of a Kamschatkan Brown Bear (*U. a. beringianus*).

The British Museum has a couple of good skins, procured in Kamschatka by St. George Littledale, and a fine series of skulls from the same country, most of them received from the Museum in St. Petersburg. It is the evidence supplied by this material that induces me to believe the names *beringiana* and *piscator* were given to the same race of bear.

The skins show the following characters :—

1. A well-preserved dressed skin (No. 0. 10.16.2) has the coat exceedingly long, between 5 and 6 ins., with the underwool mostly moulted. The colour is very varied, mottled especially on the flanks owing to the natural disarrangement of the loose coat displaying the darker basal and lighter apical portions of the long hairs. Muzzle buff with whitish sheen ; browner round the eyes. Hairs on cheeks, neck and flanks with long greyish buff tips, the bases not very dark, the general tint being greyish brown ; but the dorsal area, including the 'shoulder-mat' and the fore part of the back is darkish brown, the tips of the hairs being only a shade paler than the rest, but on each side of the 'mat' the tips are nearly white, thus emphasising the

dark hue of the 'mat'. The legs from the elbows and knees are brownish black and there is no white collar. The claws are black, those of the forepaw 2·3 ins. long, of the hind paw 1·3 in.

This skin evidently very nearly resembles the example described by Geoffroy St. Hilaire, the type of *piscator*, Pucheran.

2. A mounted specimen (No. 0. 10.16.1), possibly a little faded, shorter, coarser and closer in the coat and much paler and more uniformly buffish brown in hue, the paler tips of the hairs everywhere concealing their darker bases, which are especially darker on the back, hardly darker on the flanks. The muzzle is buffish grey, there is a brown rim round the eye but no white collar. The legs, apart from the paws which are dark brown, are the same tint as the flanks.

This bear, standing 3½ ft. at the shoulder, is indistinguishable in colour from the mounted Swedish example of *U. arctos arctos* standing alongside it, except for the dark ring round the eye.

Further evidence that 'brown' is the prevalent colour of the Kamschatkan bear was supplied by Noack who stated that skins he had seen were pale coloured, like *syriacus* (*Zool. Anz.* 1903, p. 643) and by Lönnberg's description of some skins as 'brown, brownish-grey or lighter' (*Proc. Zool. Soc.*, 1923, p. 93). Sowerby's statement that a number of skins he saw from Manchuria were 'brown' induces me to add the name *mandchuricus*, given by Heude to a Manchurian specimen, to the synonymy of *beringianus* rather than to that of *lasiotus*, since all the available evidence regarding *lasiotus* points to its being black.

The dimensions of some skulls assigned to *beringianus* are as follows:—

	Skull in English inches.						Upper teeth in millim.		Lower teeth in millim.	
Locality and sex	Total length	Cond. bas. length	Zygom. width	Mastoid width	Int. Orb. width	Max. width	Last 3 teeth	Last tooth	Last 4 teeth	Penult. tooth
Shantar Isl., ad. ♂	16·8	14·7	10·8	...	4·5	3·9	75	36 × 20	...	...
Ussuri, ad. ♂	15·7	14·8	9·1 +	...	3·7	3·6	...	...	...	...
Kamschatka, oldish ♂	16·6	15	9·5	...	4·1	3·6	84	39 × 21	92	26 × 17
,, ,, ♂	15·4	14·3	9·5	7·3	3·5	3·5	76	35 × 20	86	26 × 16
,, ,, ♂	14·4	13·8	8·8	...	3·2	3·2	72	36 × 19	81	24 × 15
,, ,, ♂	14·7	13·8	9·3	7·4	3·7	3·5	74	35 × 19	86	26 × 15

	Skull in English inches						Upper teeth in millim.		Lower teeth in millim.	
Locality and sex.	Total length	Cond. bas. length	Zygom. width	Mastoid width	Int. Orb. width	Max. width	Last 3 teeth	Last tooth	Last 4 teeth	Penult. tooth
Kamschatka, aged ♂	15·5	14·4	9·7	...	3·6	3·6+	73	34 × 19	82	24 × 14
,, young (?)♂	13	12·6	7·1	5·5	2·7	...	73	34 × 19	83	25 × 14
Udd River, adult ♀	...	12·4 ±	6·8	...	2·8	2·9	...	...	...	...
Kamschatka, oldish ♀	13·5	12·6	7·9	5·9	3	3·1	68	33 × 19	78	24 × 16
,, young ♀	12	11·5	6·9	5·3	2·6	...	71	35 × 17	78	23 × 14

The dimensions of the skull from Shantar Island are taken from Middendorff's figure of the type of *beringianus*. It is an old skull with the teeth a good deal worn. Similarly, the dimensions of the skull from Ussuri in Manchuria are taken from Heude's figure of the type of *mandchuricus*. In both these cases the measurements are no doubt only approximate; but in my opinion they supply no data justifying the view that these bears are distinct from each other or from the series from Kamschatka in the British Museum. The first and considerably the largest of these is actually longer in condylo-basal length than the type of *beringianus*, but the latter skull exceeds it a little in total length owing to the growth of the occipital crest with age. It is also considerably wider everywhere, especially across the zygomata. These differences are also attributable to age. The condylo-basal length of the type of *mandchuricus*, from Ussuri, compared with its total length and zygomatic width, suggests that it was not quite full-sized. Its measurements agree very closely with those of the Kamschatka skulls. The first three of these were received from the Petrograd Museum (No. 88. 2. 20. 13. 15). The fourth came trom Lataste's collection (No. 19. 7. 7. 36. 10). The fifth (No. 91. 12. 8. 13) was procured by Sir G. Baden Powell on the Nalotchirk River. It is a very old skull with the teeth much worn and broken. The sixth, also belonging to the Petrograd series (No. 88. 2. 20. 17), looks like the skull of a young male.

The measurements of the skull from the Udd River are taken from Middendorff's figure of a defective skull from that locality which he assigned to *beringianus*. By analogy I have inferred the condylo-basal length to be about 12·4 ins., slightly less than that of the oldish female from Kamschatka (No. 88. 2. 20 .16), which is also wider and no doubt older. The last on the list, a young female (No. 88. 2. 20. 18), like the oldish female, belongs to the Petrograd series.

The figures of of the skulls assigned, no doubt correctly in my opinion, to *beringianus* by Heude and Courtois show them to be immature, but the molar teeth of a young specimen agree very closely in size with those of of the Kamschatka skulls in my table.

As regards their shape, Middendorff's figure of the typical male skull of *beringianus* shows it to be 'high-browed'. Sowerby was apparently unacquainted with this figure, because he excluded this bear from his spurious genus *Spelæus*, a name resuscitated for the high-browed representatives of this group. He also excluded from *Spelæus* the bear represented by the skull described by Heude as *mandchuricus*. But Heude's figure shows that the brow is moderately elevated, quite as much as one would expect in a skull shown by its dimensions to be not quite full-sized, as stated above. I may add that the large size of the upper carnassial tooth, the antepenultimate of the series, upon which Heude relied as the main character for *mandchuricus*, is an individually variable feature and does not possess the systematic importance attached to it.

All the adult and old male skulls from Kamschatka in the British Museum are 'high-browed', like the male of *Ursus arctos arctos* from Olonetz in Russia, above referred to; but they vary very considerably individually in this respect, no two being alike. The adult female skull, on the contrary, is comparatively low-browed and is indistinguishable in this particular from the female skull of *beringianus* Middendorff from the Udd River.

Conclusion. I have not seen a sufficient number of skins of *beringianus* to determine whether this race differs from typical *Ursus arctos arctos* in colour; but the tables of cranial and dental measurements of the two show that *beringianus* has on the average a bigger skull and bigger teeth. Since, moreover, all the adult male skulls of *beringianus* with which I am acquainted are 'high-browed,' there is some evidence that at all events a larger percentage of the skulls of this sex exhibit that condition than is the case in the European race.

THE MANCHURIAN BLACK BEAR.

Ursus arctos lasiotus, Gray.[1]

Ursus lasiotus, Gray, *Ann. Mag. Nat. Hist.* (3), 20, p. 301, 1867; *id. Cat. Carn. Brit. Mus.*, p. 223, 1869; Sclater, *Proc. Zool. Soc.* 1867, p. 818; Lönnberg, *Proc. Zool. Soc.*, pt. 1, p. 91, 1923.

Melanarctos cavifrons, Heude, *Hist. Nat. Chin.* V, pt. 1, p. 1, pl. 1, 1901; Courtois, *op. cit.* pl. xix.

Spelæus cavifrons and *piscator*, Sowerby, *Journ. Mamm.* I, No. 5, pp. 230 & 232, 1920.

Ursus cavifrons, Howell, *Proc. U. S. Nat. Mus.* 75, p. 21, pls. 8 and 9 (skull), 1929.

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[1] I am unable to find evidence that the bears, to which the names cited in the synonymy were given, are racially distinct from each other. There are, on the contrary, many good reasons for considering them to be inseparable. But since my personal acquaintance with them is limited to a few skins and skulls, I have divided the synonymy and the account of them geographically, dealing, first, with the specimens recorded from the mainland, secondly, with those from Japan.

(?) *Ursus arctos baikalensis*, Ognev, *Nature and Sport in Ukraine* (transl. of Russian title), p. 5, 1924.
Ursus ferox, Temminck, *Fauna Japonica*, p. 29, 1844 (not *ferox* of Shaw).
Ursus arctos yesœnsis, Lydekker, *Proc. Zool. Soc.* 1897, p. 422.
Ursus yesœnsis, Courtois, *Mêm. Hist. Nat. Chin.* V, pp. 33-35, 1906; Sowerby, *Journ. Mamm.* I, p. 227, 1920.
Ursus melanarctos, Heude, *Mêm. Hist. Nat. Chin.* IV, p. 17, pls. vii & viii, 1898.
Spelœus melanarctos, Sowerby, *Journ. Mamm.* I, p. 230, 1920.
Locality of type of *lasiotus:* interior of Northern China.
,, ,, *cavifrons:* Tsi-tsi-har, N.-W. Manchuria.
,, ,, *baikalensis:* Province of Irkutsk.
,, ,, *ferox*, Temm: Yeso Island, Japan.
,, ,, *yesœnsis:* ,, ,, ,,
,, ,, *melanarctos:* ,, ,, ,,
Distribution: Mongolia, Manchuria, Yeso and the Kuriles.

SPECIMENS FROM MONGOLIA AND MANCHURIA.

There appear to be only five skins of this bear from these countries preserved in Museums. Two of them are in the British Museum.

1. The skin of the type of *lasiotus*. This bear was imported as a living animal from the interior of Northern China on September 14, 1867 and presented to the Zoological Gardens where it died on June 29, 1893. In accordance with the date of death the coat is comparatively short and coarse and the underwool is in full moult, some of it still remaining attached to the bases of the longer hairs but much of it has entirely disappeared. Apart from the muzzle which is dark brown, the general colour is jet black and glossy all over, with brown reflections in certain lights and brown in patches where the hairs are disturbed, so as to display the brown underwool. There is no trace of a white collar, and the claws are black and strongly curved but much worn by the concrete flooring of the cage. The hair is about 2½ or 3 ins. long.

2. The second skin, which I assign to this race, also belonged to an adult bear which was presented to the Zoological Gardens by F. Ringer and was said to have come from the coast of Eastern Siberia. It was identified by Sclater as *piscator* and died in May 1918. Sowerby who saw this specimen, when dead, said that it reminded him very much of a big black bear he shot in Kirin in N.-W. Manchuria and identified as *cavifrons;* but had softer hair. Although the animal died in May, the coat shows, perhaps unexpectedly, no sign of the moult. Possibly the moult was delayed by failing vitality due to approaching death. However that may be, the coat is long, soft and luxuriant, with abundance

of brown underwool. The muzzle is rather paler brown than in the type and there are some brown-tipped hairs on the forehead and throat. Elsewhere the general colour is mostly glossy black, but the hairs of the back are stippled with short, almost golden tips which possibly accounts for Sowerby's misleading statement that the colour was dark brown. There are no pale tips to the hairs on the rump, legs and under side. The underwool is paler than in the type and mottles the blackness with brown patches when the hair is parted. The claws are as in the type. The hair of the neck and back is between 5 and 6 ins. long, and on the flanks as much as 8½ ins.

3. Heude's specimen of *cavifrons* from N.-W. Manchuria was also black. Hence the generic name *Melanarctos* he applied to it.

4. Sowerby's specimen, an adult male, from the I-mien-p'o district of North Kirin in Manchuria, where he shot it on October 8, is in the United States National Museum. He described its colour as generally black, merging into brown on the muzzle and head, with a band of slightly lighter colour on the shoulders, owing to the hairs being light chestnut at their bases, indicating an evanescent collar. The hair, he adds, is very coarse, with little underwool. This bear, measured in the flesh, was: head and body 6 ft. 7 ins., tail 5½ ins.

5. Lönnberg's specimen, undated, came from Northern Mongolia. It is black with a brown muzzle and some brownish tint on the forehead and shows on the sides of the neck a faint chestnut-reddish lustre. The underwool is well developed and dark brown and the claws are blackish horn-coloured.

There is, I think, no doubt that the skins above described represent the same race of bear, *lasiotus*, which differs from *beringianus* in being mainly black instead of brown. No doubt the two completely intergrade.

I have provisionally assigned to this race the unidentifiable bear described by Ognev as *baikalensis*. As Howell observed ' its type locality is apparently the Irkutsk part of the Sajan Mountains, south of Lake Baikal, close to the borders of Mongolia, about lat. 50° N. Howell suggested that *baikalensis* might prove to be synonymous with the species he wrongly assigned to *leuconyx* which is in reality *pruinosus*. The latter, so far as I am aware, does not occur north of Kansu, south of 40°N. lat. His suggestion on this head was due in part to his erroneous belief, inspired apparently by Sowerby, that the type-locality of *leuconyx* is the Altai Range. This point is further touched upon below under the synonymies of *pruinosus* and *isabellinus*.

The following are the dimensions of the skulls assigned to this race. The skull of the type has not previously been measured or described.

	Skulls in English inches						Upper teeth in mm.		Lower teeth in mm.	
Locality and sex	Total length	Cond. bas. length	Zygom. width	Mastoid width	Int. orb. width	Max. width	Last 3 teeth	Last tooth	Last 4 teeth	Penult. tooth
N. W. Manchuria, ad. ♂	16	...	9·3	..	3·5	...	...	...	...	...
N. E. Asia *Type* old ♂	15·9	14·9	9·4	8·1	3·7	2·7	75	37 × 19	85	26 × 17
North Mongolia ad. ♂	15·5	...	8·7	...	3·2	3·1 +	75	35 × 18	84	25 × 16
N. W. Manchuria ad. ♂	14·4	13·8	7·8	...	3·6	3	68	30 × 16	71	25 × 14
,, ♂	14·2	...	7·6	...	3·8	3	...	...	...	...

The first skull on this list is the one recorded by Sowerby from N. Kirin, in Manchuria.[1] Unfortunately very few particulars were supplied; but so far as they go, the measurements are in very close agreement with those of the second on the list, the skull of the menagerie-kept type of *lasiotus*. But the two skulls clearly differ in the shape of the brow. Sowerby's specimen, identified as *cavifrons* Heude, has the brow high, as in adult males of *beringianus*, with a marked concavity where the forehead passes into the muzzle. In the type of *lasiotus*, on the contrary, there is no such hollow, that area of the skull being inflated with air-cells and lightly convex between the orbits, not between the post-orbital processes behind. Hence the brow is not elevated. The third on the list is the specimen, presumably adult, recorded by Lönnberg as *lasiotus*. This also has a low brow, Lönnberg expressly saying 'Our Mongolian Bear shows a cranial outline which at the forehead is nearly straight.' But his knowledge of Swedish brown bears prevented him attaching importance to this point. The measurements of the fourth and fifth specimens from N.-W. Manchuria are taken from figures of *cavifrons* published by Heude and Courtois. The figures were probably taken from the same specimen; but the dimensions do not exactly tally. The fifth at all events is the type of *cavifrons*. Sowerby examined this skull and decided that it represented the same race of bear as the much larger skull he procured at Kirin in Manchuria. Although the differences are considerable, they are not greater than those between adult male skulls of *beringianus* from Kamschatka and I see no reason for dissenting from Sowerby's verdict.

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[1] Apparently the skull, assigned to *Ursus cavifrons* and figured by Howell in 1929, is the one in question. According to the photograph of the ventral view, said to be two-fifths natural size, the condylo-basal length of this skull is 15·5 ins., which is difficult to reconcile with Sowerby's record of the total length as 16 ins.; and the length of the last 3 upper cheek-teeth is over 87 mm. Since, moreover, Howell, gives the dimensions of the last upper tooth as 43 × 21⅕ mm., it is clear that the bear has larger teeth than any known European or Asiatic bear.

It may be noticed that whereas all the skulls of adult males of *beringianus* are 'high-browed', two out of the four known male skulls of *lasiotus* are 'low-browed'. But the skull of the type of *lasiotus*, which, by the way, is exceptionally wide across the mastoids may have been affected by many years in captivity, although the animal was apparently full-sized, if not absolutely mature, when received. I suspect that the skull measured by Lönnberg had not attained its final form.

Conclusion. So far as the available evidence goes, this bear is as large as *beringianus* and like it in cranial and dental characters, but differs on the average at least in the prevalent blackness of its hue. It is similarly darker than the European race and also larger.

Specimens from Yeso, Japan

Since Temminck's account of this Japanese bear, which he identified with one of the North American races, was ignored by the later writers, who redescribed it under the names quoted in the synonymy, it is important to reproduce his description, based upon an examination of many skins possibly attesting great variation in colour.

It inhabits the mountains of Yeso and Karafto (Saghalien) and is of enormous size, the skins measuring 7 or 8 ft. long. The general colour is dark brown, more rarely blackish (*noirâtre*), some individuals being paler on the head and forequarters and some showing a yellowish band across the shoulders, resembling the variety from Siberia known as the Collared bear (*U. arctos collaris*, Cuv.). Another variety is more tawny (*plus fauve*) and is known to the natives as the 'fiery bear' (*ours de feu*) or the red bear (*ours rouge*). Temminck, however, regarded varieties as due to differences of age and of coloration of the pelage of one and the same animal.

Temminck may have been perfectly correct in regarding these brown and black skins as belonging to the same race of bears. In that case the view that *yesoensis* is distinct from *beringianus* and *lasiotus* and that these two are distinct from one another would be difficult to maintain, as will be shown in what follows. But I suspect Temminck's information was based largely upon skins observed in the market some of which may have been imported to Japan from the mainland of Manchuria, where the bears are at all events frequently 'brown'.

The only skin I have seen is that of a young ♂ from Yeso exhibited in the Zoological Gardens from 1869 to 1871, which died in June when just beginning to moult the winter coat, the underwool being detached from the skin but still adherent to the long hairs. General colour very dark brown owing to the combination of the greyishbuff tips of the long hairs with their black basal portions. The paler wash much more in evidence on the flanks than on the shoulder-mat and the mid-line of the back, where the hairs are almost entirely black. The newly erupting long hairs at the base of the old ones almost entirely black. Legs jet black. No trace of collar. Head lustrous brown on forehead, noticeably brown and paler than the body ; the paler tint of the cheeks extending on to the throat. A quantity of wholly tawny hair in the axilla, as in *pruinosus*, and the hairs of the ventral surface apically pallid, grizzled with greyish yellow. Claws black, normal in shape and length.

The resemblance of this bear to some examples of *pruinosus* in colour, especially in the contrast between the paler head and the darker body, the general blackness of the hairs on the body and legs, the pale hue of the throat, chest and axilla, is unmistakable. But there is no trace of the white collar, although judging from its small size, the animal was only about half grown.

In the absence of the collar, the blackness of the limbs and mostly black body-hair, it also recalls the Mongolian and Manchurian Black bear (*lasiotus*). But the recorded skins of the latter have the head darker, not sharply contrasted with the body and scarcely a trace of pale hair on the throat and none on the chest, axilla or belly. We know, nevertheless, from Heude's description of *melanarctos* that wholly black bears occur in Yeso ; and Courtois has an interesting note on a young bear, believed to be eight months old, received alive in December from Hokkaido (Yeso), which was tawny-yellow (*fauve blond*) in tint. But by October of the following year, when it was killed, it had become noticeably darker, certain parts being black. From the evidence of this cub and the half-grown specimen in the British Museum, it seems probable that the Yeso bear is brown when young and gradually gets black with age.

Sowerby maintained that there are two ' genera ' of bears of this group in the Island of Yeso, namely, *Ursus yesœnsis* of Lydekker and *Spelæus melanarctos* of Heude. To substantiate this opinion he wrote :— ' As Lydekker distinctly states that his *yesœnsis* is a brown bear, while Heude states equally emphatically that *melanarctos* is pure and deep black, it is obvious that the two forms are distinct. The skull figured by Lydekker does not agree with the characters of *melanarctos*, and is, in effect, that of a true brown bear. It has a very convex cranial outline.'

There is, however, no evidence that Lydekker saw the skin I have described above. At all events he did not refer to it ; and in saying that *yesœnsis* is a brown bear, he merely meant that it is a member of the *arctos*-group, which is perfectly correct.

Admittedly the skin described above is not wholly black, but there is so much black about it especially on the limbs and the newly erupting coat, that I have no doubt, making allowance for individual variation, it belongs to the same race as the ' black ' bear from the same island described by Heude. It seems to me to be in the highest degree improbable that there are two distinct species or even races of *Ursus* found in Yeso.

As regards the skull, the untenability of Sowerby's view that the elevation of the forehead is a generic character, has already been demonstrated. Nevertheless anyone acquainted with bears' skulls can see at a glance that the skull of the type of *yesœnsis* (B.M.

No. 86.11.18.2), figured by Lydekker, is that of an immature animal. Hence the convexity of the dorsal cranial outline. I am quite unable to surmise why he chose that particular skull to illustrate when there was a considerably older and larger male (B.M. No. 96.4.27.1) available. But so it was. This older skull has not the convexity of outline of Lydekker's typical example. The slope of the back of the crown is almost obliterated by the sagittal crest, the forehead is not so rounded but is markedly more abruptly depressed in front of the post-orbital processes. As the measurements show, this skull belonged to a large bear with big teeth, the only peculiarity about it being the narrowness across the zygomata. But this I attribute to its being clearly a young-adult, the teeth being quite unworn and most of its cranial sutures still unclosed. Its dimensions agree very closely with those of the Northern Mongolian skull assigned by Lönnberg to *lasiotus*, a race to which *yesœnsis* is clearly closely allied even if it be not identical with it.

This view is confirmed by the figures of the skulls of the Yeso bears published by Heude and Courtois. Heude, as shown in the synonymy, described this bear as *Ursus* (*Melanarctos*) *melanarctos*. The male skull has a high rounded forehead, considerably higher than in the largest specimen from Yeso in the British Museum. But it is not distinguishable by any character that I consider to be of systematic value from the skull of the male Manchurian black bear he described as *Ursus* (*Melanarctos*) *cavifrons*, which Lönnberg has shown to be in all probability *lasiotus*. Heude also figured the skull of an adult female from Yeso, showing that it differs markedly from that of the male in its low, flat brow. These two skulls, ♂ and ♀ of *Melanarctos*, according to Sowerby, represent distinct genera. Courtois published fresh figures of Heude's specimens, and perceiving the immaturity of the type skull *yesœnsis* described and illustrated by Lydekker, quite correctly, in my opinion, regarded *Melanarctos* as a synonym of *yesœnsis*. It is not easy to square the exact dimensions of the figures of the skulls and teeth of these bears published by Heude and Courtois respectively. I cannot, however, find any trustworthy evidence that the Yeso bear differs in cranial or dental characters from the Manchurian bear *lasiotus ;* but my acquaintance with actual skulls of *lasiotus* being restricted to the solitary type, from a menagerie-reared animal, in the British Museum, I do not feel justified in assuming that the two are sub-specifically identical, although I strongly suspect that they are.

Provisionally, I assign to *yesœnsis* the skull of a bear from Jelorop Isl., Kuriles (C. Maries, 80.3.30.4) which unfortunately has no skin. It is fully adult and, I think, a female. There is nothing in its characters to forbid that identification. It is slightly larger but very much the same shape as the old female skull from Kamschatka assigned to *beringianus*. Heude, it may be added, was informed of the existence of a very large black bear in the Kurile Islands (*Mém. Hist. Nat. Chin.* V, p. 1. 1901).

The following table gives some cranial and dental measurements of the skulls of *yesœnsis* in the British Museum and of one figured by Courtois. Also similar measurements of the skull of the type of *shanorum*.

	Skull in English inches						Upper teeth in mm.		Lower teeth in mm.	
Locality and sex	Total length	Cond. bas. length	Zygom. width	Mast. width	Int. orb. width	Max. width	Last 3 teeth	Last tooth	Last 4 teeth	Penult. tooth
Yesœnis										
Yeso. subad. ♂ ...	15·5	14·1	8 5	6·7	3·3	3·1	77	37 × 21	87	27 × 17
Yeso. (Courtois) ♂	...	14·1	8·2	6·8	...	3·2	80	41 × 20	87	28 × 17
Yeso. (Type) ...	14·7	13·4	7 6	6·1	3	3	74	35 × 19	82	25 × 15
Yeso. yg. (?) ♀ ...	10·7	...	...	...	2·2	2·4 –	68	33 × 17	...	...
Jelorop, Kurile Islds. ad. (?) ♀ ...	13·9	13	8·3	6·7	3·1	3 +	72	35 × 19	79	25 × 14
Shanorum										
(?) Shan States, young ♂ ...	13·1	12·3	5·4	5·6	2·3	2·9	74	36 × 18	84	25 × 15

The dimensions of Courtois's skull of *yesœnsis* in this table are taken from his figure of the ventral surface which shows distinct traces of the occipital suture, proving that the animal was not an 'old male', as he described it. It was younger than the first on the list, which accounts no doubt for its narrower zygomata. Neither of these skulls is so old as the male skulls of *beringianus* from Kamschatka, There is, however, close agreement in their dimensions, allowing for increase in width of the Yeso skulls, if they had been a few years older. There is also no difference in the size of the teeth.

The So-called Burmese Brown Bear.

Ursus arctos shanorum, Thomas.

Ursus arctos shanorum Thomas, *Proc. Zool. Soc.* (*Abstr.*) p. 17 March 20, 1906; also p. 231, fig. of skull, 1906.

Alleged locality of type and only known specimen: The Shan States, Upper Burma.

The type of this bear (B. M. No. 6. 3. 16. 1) was sent to Thomas from the Calcutta Museum by Nelson Annandale who received it from Rutledge, a live-animal dealer, in whose possession it had been for a short time. Judging from the length of its claws it had been somewhere in captivity on boards for a considerable period. Rutledge told Annandale it came from the Shan States; but no bears of the *Ursus arctos* group, so far as I am aware, have been recorded from any locality near that part of tropical Asia ; and since dealers' localities for their live-stock are frequently untrustworthy, I find it impossible to accept the Shan States as the home of this bear without further evidence.

The specimen, however, is remarkable in many ways and I cannot affiliate it with any of the subspecies of *Ursus arctos* admitted in this paper.

It is a young male. The head and muzzle are rather pale brown, paler than the nape and ears, and on the posterior part of the nape a median broad blackish brown band sets in and runs backwards over the shoulder-mat down the middle line of the back, the hairs of this band having small, reddish brown tips. On the flanks and shoulder below the mat the tips of the hairs are grey. For this reason and on account of the bases of the hairs on these areas being rather paler brown, they are markedly lighter in tint than the dorsal area. The underwool is everywhere dirty grey, darker on the dorsal area than elsewhere.

The limbs are not darker than the body, the tips of the hairs on the fore limb showing a reddish buff sheen. The chin is reddish brown, the throat-hairs are whitish at the base with pale brown tips ; the hairs of the chest and abdomen are dusky brown with pallid tips. From the tolerable abundance of underwool and the general length and condition of the coat the animal was probably in late autumn pelage. The hairs on the shoulder mat are nearly 4 ins. long, on the sides of the neck and flanks 3 ins. or more, on the back about 2½ ins. and on the fore leg, where they are unusually long, up to 4 ins.

The claws are black and remarkably long, those of the hind paw being about 2 ins , and those on the forepaw as much as 3·7 ins. They are much longer than the claws of any example of *U. arctos* I have seen ; but I have a strong suspicion that the abnormality is not natural and is due to a comparatively long period of captivity in cages with boarded, not concrete floors.

The skull of *shanorum* has all the sutures open and is quite young as shown by its shape depicted in the figure published by Thomas, who seems to have regarded it as approximately full-sized. It is about the same age as the skull of the type of *yesœnsis*, but has the teeth more worn. The teeth are nearly the same size as in the type of *yesœnsis ;* but the skull itself is considerably smaller, indicating a smaller race of bear. It is remarkably narrow, narrower as compared with its length than the skull of any *U. arctos* of corresponding age I have seen. The frontals are peculiarly compressed towards the summit and the inter-orbital width is markedly less than the width of the maxilla at the root of the canines, an unusual feature in an *arctos* skull of corresponding age. The sagittal crest is remarkably high posteriorly for so young a bear, noticeably higher than in the type of *yesœnsis*. The upper carnassial tooth is large, with a big inner lobe. The size of this tooth may vary, however, individually in bears irrespective of wear, as shown by the male and female skulls of *pruinosus* from the same locality collected in W. Kansu by Fenwick Owen (cf. *infra*). The last molar of the lower jaw is unusually wide and rounded posteriorly. Unfortunately, this bear had been in captivity for an unknown period and it is impossible to say to what extent its cranial peculiarities may have been affected by that condition.

Thomas compared this skull particularly with that of the type of *yesœnsis*, thinking the likeness between them, due in reality to mutual immaturity, indicated kinship. But the skull of *shanorum* is at least as much like the skull of *isabellinus;* and *isabellinus* occurs in the Thian Shan. Possibly the locality of *shanorum* was Thian 'Shan' and not the 'Shan' States. However that may be, the bear cannot on the evidence be associated with *isabellinus* because of its differences in dental and cranial characters and black claws.

The Blue Bear of Tibet.

Ursus arctos pruinosus, Blyth.

Ursus pruinosus, Blyth, *Journ. As. Soc. Bengal*, 22, p. 589, 1853; Blanford, *Journ. As. Soc. Bengal*, 46, pt. 2, p. 318, 1877; W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. 2, p. 302, 1891; Lydekker, *Proc. Zool. Soc.*, 1897, pp. 412–415 and 814; Leche in Sven Hedin's *Central Asia*, 6, pt. 1, p. 4, 1904.

Mylarctos pruinosus, Lönnberg, *Proc. Zool. Soc.* 1922, p. 85.

Ursus lagomyiarius, Severtzow, *Cat. Zool. Coll. Przewalski*, p. 9, 1887.[1]

Ursus pruinosus + *U. lagomyiarius* + *U. clarki* (in part) + *Spelæus leuconyx*, Sowerby, *Journ. Mamm.* I, pp. 225–226 and 232, 1920. (Not typical *clarki;* not *leuconyx* Severtzow).

Ursus leuconyx, Howell, *Proc. U. S. Nat. Mus.*, 75, p. 22, pl. 10, (skull) 1929 (not *leuconyx* Severtzow).

Locality of type of *pruinosus;* Lhasa in Tibet.
" " " *lagomyiarius;* Kansu.
Distribution.—Western China (Kansu, Shensi) and Tibet.

The literature of this bear reveals surprising diversity of opinion on its systematic status, the extremes being the view of W. L. Sclater that it is the same race as the Red bear (*isabellinus*) and the view of Lönnberg that its characters entitle it to separation from the rest of the *Ursus arctos* group as a distinct subgenus *mylarctos.* Between these two are the views of others who give it specific rank. In my opinion it is a local race of *U. arctos.* I have already given my reasons for rejecting Lönnberg's view of the subgeneric importance of the species, a view based upon the large size of the teeth and the structure of the paws, both of which characters are extremely variable. The bear is certainly racially distinguishable from *isabellinus* and from the races of *U. arctos* inhabiting more northern parts of Asia; but it shows so many cross resemblances to some of them that I find it impossible to mention a single distinctive character by which it can be defined as a species.

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[1] I have failed to trace the name *lagomyiarius*, Severtzow, in the bibliography of it given by Trouessart (*Cat. Mamm.* I, p. 18). The first work, *Fauna of Turkestan*, is the translation of the Russian title of the paper in which Severtzow described *Ursus leuconyx* (= *isabellinus*), but not *lagomyiarius.* The second reference is to Przewalski's *Reise Mongol.* In Vol. II, pp. 249–250, 1876, of the English translation of this work by E. D. Morgan, Przewalski refers to the bear in Kansu, but gives it no technical name. But in Severtzow's Catalogue of Przewalski's collection in the St. Petersburg Museum, of which there is a copy in the Library of the Zoological Society, the name appears; and since it is marked 'n. sp.', it must be assumed that it was first published on that occasion in 1887. Leche quotes it as a synonym of *pruinosus* and assigns it to Severtzow, but without other reference to its source.

I follow Leche in citing *lagomyiarius* Severtzow as a synonym of *pruinosus.* If Leche's statements regarding the variations in colour and other characters of this bear had been known to Sowerby he would possibly have held different views regarding it from those expressed in his paper. His opinion of *pruinosus* was taken from Lydekker's account of the young and unusually grey specimen he described and figured. Its immaturity accounts for its small size, which Sowerby quoted as a specific character, and its greyness is no doubt attributable to the bleaching of the tips of the hairs of its old winter coat. These were the two features mentioned by Sowerby as distinguishing *pruinosus* from *lagomyiarius.* The name *clarki* was proposed by Sowerby for a bear from S.-W. Shensi which Heude described as *Selenarctos leuconyx.* According to Sowerby this bear belongs to the genus *Ursus;* and since *leuconyx* was preoccupied for another bear, so-named by Severtzow, Sowerby substituted *clarki* to designate Heude's species. But judging from Heude's figure of the skull of *Selenarctos leuconyx*, the bear belongs to that genus and not to *Ursus.*[1] Nevertheless under the heading *Ursus clarki*, known to him only from the alleged typical skull of *S. leuconyx*, Sowerby wrote: 'When I was in this locality, S.-W. Shensi, I made enquiries concerning the form of the bear inhabiting these mountains, part of the Ching Ling Range, and was told that it was whitish in colour with some black about it. . . . . The species would seem to represent *U. pruinosus* in this region.' This description agrees well with the example of *pruinosus* from Lhasa figured by Lydekker.

With regard to *Spelæus leuconyx* Sowerby and *Ursus leuconyx* Howell, the bears from Kansu so-named were unquestionably wrongly identified, *leuconyx* of Severtzow, from Thian Shan, being the same as *isabellinus* Horsfield, as stated below.

I have seen five complete skins of this bear:

1. A skin picked up in 1928 at Lhasa, Tibet, by Sir Charles Bell who kindly lent it to me. It is undated, but since it agrees precisely, so far as can be judged, with the skin originally named by Blyth, I shall describe it first. The general colour is black just frosted with grey and very variable according to the fall of the light, the pale tips elusively disappearing at times, then leaping up with silvery sheen as they catch the light when the skin is turned; but the pale areas on the hairs are small as compared with the black. The snout buffy, the head brown with golden reflections, the pale colour from the cheeks extending on to the throat which is dirty white; there is a good deal of pale hair also in the axilla and on the chest. A snow-white collar 5½ inches wide, interrupted in front of the shoulder by an area 3½ inches wide. The rump scarcely silvered;

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[1] My reasons for this belief will be given later under the genus *Selenarctos.*

the legs and belly black. No claws on the skin. The hair on the back measures about 3 inches, on the neck about 4 inches, on the flanks 3½ inches. There is a good deal of underwool, brownish black in hue.

There is no date for this skin; but the condition and length of the coat suggest October or November, later at all events than the skin next described.

2. A skin in summer coat, briefly described by R. Lydekker, from the foot of Namoran Duran Pass between N.-E. Tibet and Isaidam, September 22, 1896, Capt. Neill Malcolm. (B. M. No. 0.11.13.1). Coat with the same elusive silvery sheen as in the last, Sir Charles Bell's skin, confusedly clouded black and grey, with a rufous wash on the nape and back, but the whole skin much paler owing to the dominance of the grey over the black in the individual hairs of the comparatively short coat. Snout greyish buff, head golden brown, ears brown; throat, axilla and chest pale brownish grey. The rump and legs are deep blackish brown, not so black as in Sir Charles Bell's skin, but darker brown than in any example of *U. arctos isabellinus* I have seen. The white collar, similarly interrupted above, is about 4 inches wide. The underwool is practically absent, the skin being easily exposed by parting the hairs. The hairs on the back measure about 1¾ inches, on the flank 2½ inches; the claws are pale horn-coloured, just over 2 inches on the forefoot and over 1 inch on the hind foot. The skin measures 4 ft. 8 inches, but there is no skull whereby its age can be estimated.

3 & 4. The skins of an oldish female and an immature male from the Minshan Mountains, W. Kansu, generously presented to the Museum by Capt. G. Fenwick Owen and mentioned by F. Wallace in *The Big Game of Central and Western China*, 1913, pp. 195–196 and 295.

♂ October. Face tawny brown; ears black with hair-tips reddish buff; tips of hairs on forehead, crown and nape golden red, duller on sides of head and cheeks, no black visible on these areas unless the hair is disarranged. On the shoulder-mat the tips are less bright, buffy-grey, with the pale areas much less extensive than on the nape and not concealing the black of the basal areas. Middle line of back behind the mat like the head and with similar bright sheen; but on the flanks, loins and rump the pale tips are less extensive and less bright and turn to greyish on the upper part of the thigh. Belly dark brown, passing into red on the breast. A complete collar of wholly white hair running up to the sides of the shoulder-mat and passing in front of it across the middle line, but here the hairs are tinged with red at the base. For the rest the hairs are everywhere black at the base and there is a comparatively small amount of underwool. The hairs on the neck, shoulder-mat and flanks are from 4 to 5 ins., on the back from 3 to 4 ins. The legs are black; the claws mostly pale horn-coloured, but streaked more or less with dark grey; the fore claws are nearly 2½ ins. long, the hind about 1¼ ins. This skin measures 5 ft. 5 ins. to the root of the tail.

♀ October. Generally similar to the last, but with the breast and mid-line of the belly quite white and with less red on the back behind the shoulder-mat, the body here blacker, especially over the loins and rump. The claws are darker coloured, intermediate in tint between pale horn and the normal wholly dark tint of typical *U. arctos.* Fore claws much shorter, worn, only about 1½ ins long.

These two skins agree closely with the specimens from Kansu and Tibet described by Lönnberg. They have more red, especially the ♂ first described, than Capt. Neill Malcolm's skin. The female skin is interesting from having claws intermediate in tint between the typical pale horn-colour of most specimens of *pruinosus* and the dark claws of European and northern Asiatic races of *U. arctos.*

Under the name *Ursus leuconyx*, Howell recorded an immature specimen of this bear from Taochow, Kansu. He detected the resemblance of this young bear to one of Fenwick Owen's specimens photographed in the volume quoted above.

5. Skin in winter coat, described and figured by Lydekker, from N.-E. of Lhasa, Tibet, presented by Capt. H. Bower (B. M. No. 92.10.9.1). Coat very long, thick and tufted, general colour mottled grey and black owing to the tufting and disarrangement of the pallid outer part of the hair showing the dark basal part. Outer part of all the hairs of the back and flanks grey but with hardly a trace of the silvery sheen seen in the summer coat; the inner part black; but the copious underwool is brown, not black, quite grey brown on the flanks. The shoulder-mat is large and almost wholly black, flanked by white tipped hairs and preceded by a wide collar which is complete dorsally. Snout whitish, top of head and ears the same colour, grey, the ears not white and contrasted as shown in Lydekker's figure. Throat, axilla and breast white. Rump not so speckled as flanks, darker; paws and lower legs deep brownish-black. Hairs on shoulder-mat and sides of neck 7 ins., on back 5 to 6 ins.

From the length, thickness and general condition of the coat, I have no doubt this bear was killed shortly after emerging from winter quarters. The contrast between it and Sir C. Bell's specimen in colour and texture of coat is very striking but both came from Lhasa. The skin described by Blanford also came from Lhasa and there is no doubt that his original identification of it as *pruinosus* was correct, although, in consultation with Lydekker, he later changed his mind on the point. This skin, like the type described by Blyth, was brought from Lhasa to Darjeeling, and had the hair felted and matted suggesting that it was nearing the moult. It exhibited a hoary appearance owing to the fulvous tips to the hairs. The hair on the back was 3 ins. long, on the shoulder from 3½ to 4 ins. From Blanford's description I am inclined to think the moult was well advanced. This would account for the hair being considerably shorter than in Capt. Bower's specimen and also felted and matted. It is evident too that Blanford's specimen was not nearly so greyish-white as the other, which shows no 'fulvous' tinge in the pelage.

The head-skin of a specimen from Central Tibet, probably North of Lhasa, brought in by native collectors 'from far beyond any of the regions accessible to Europeans' (H. J. Elwes, B.M. No. 84. 3.5.1), is pale brown with a dark ring round the eyes. On the forehead the short hairs are deep brown at the base, pale at the tips; on the crown where the hair is long the colour is deeper and the pale tips little in evidence; the ears are clothed with black hairs, without pale tips.

There are three good skulls of this race in the British Museum.

The two from Kansu presented by Fenwick Owen differ considerably in shape and in a variety of other particulars, due mostly no doubt to age. The female skull is that of an oldish animal, all the cranial sutures being obliterated. Nevertheless the sagittal crest is low and short, the forehead, although broad, is not inflated or mesially depressed; the profile of the nasals is slightly undulating, with a shallow concavity in their posterior half, and the muzzle is higher and shorter than in the male. The cusps of the teeth are a good deal worn, but neither the width nor the length of the teeth appears to have been affected. The teeth are all smaller than in the male skull, the most noticeable difference being in the upper carnassial, the ante-penultimate tooth. In the female this tooth measures 16 by 13 mm. In the male it is not only longer but much wider, measuring 18 by 16·5 mm., a very remarkable and instructive instance of individual variation in the size of the teeth in bears of the same race.

The male skull has a smooth, rounded, slightly inflated forehead with small post-orbital processes, but no frontal concavity; the nasals are evenly sloped, the muzzle is long and low and the sagittal crest is scarcely developed. It may also be especially noted that the anterior border of the ascending process of the mandible does not conceal the posterior end of the last lower molar in profile view.

The skull of the specimen described by Lydekker from N.-E. of Lhasa (Capt. H. Bower, B. M. No. 92.10.9.1) is a little younger and considerably smaller than the last, but is similar in shape, allowing for the difference in age, the muzzle being even more depressed. The teeth are much smaller, although equally unworn. A marked difference lies in the mesopterygoid region. In the small Lhasa skull the post-dental extension of the palate is very short, its median length being about $\frac{1}{4}$ its anterior width. In the larger Kansu skull the median length is about $\frac{1}{2}$ the anterior width. In the Lhasa skull also the mesopterygoid fossa is markedly wider and rounded in front. It is quite clear from Lönnberg's figure of his skull from S.-W. Kansu that the post-dental palatine extension is short as in the example from Lhasa, and not long as in Capt. Fenwick Owen's specimen from Kansu; but its mesopterygoid fossa is more like that of the latter.

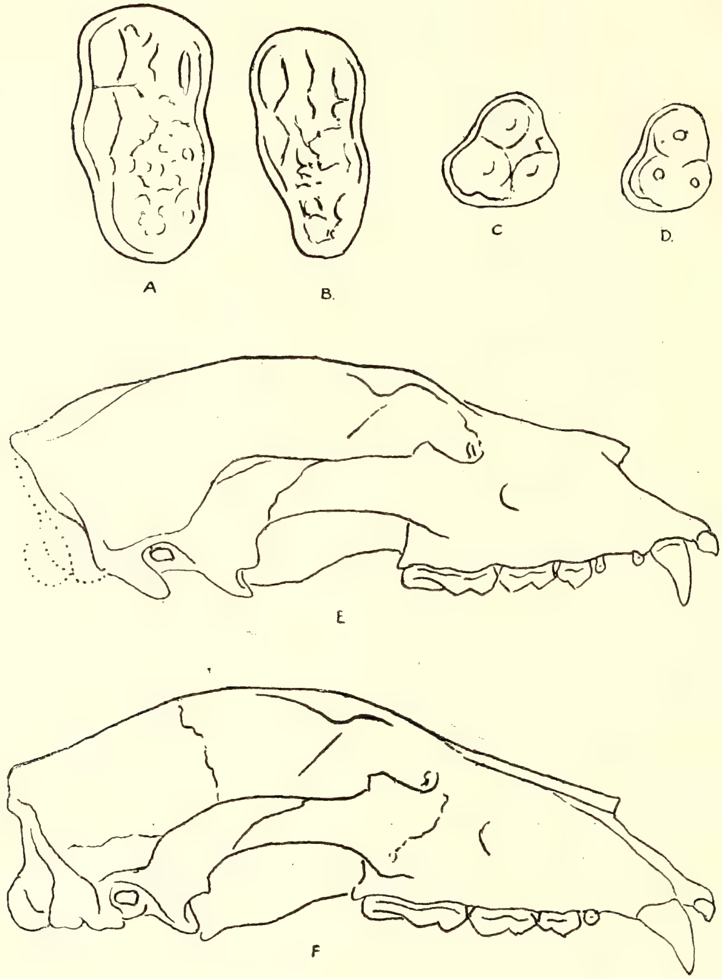

FIG. 10.

Teeth (nat. size) and skulls of Blue or Snow Bears (*U. a. pruinosus.*)

A. Last upper molar of right side of adult female from Kansu.
B. The same of the young female from Lhasa.
C. Right upper carnassial (pm^4) of young male from Kansu.
D. The same of the old female from Kansu.
E. Side view of skull of the same.
F. The same of young male from Kansu.

The skull of the very old male figured by Leche differs from the oldish female skull procured by Capt. Fenwick Owen in being flatter along the crown owing mainly to the greater height of the sagittal crest at its posterior end. The line of the nasals too is straighter, without any uptilt anteriorly. Also the upper edge of the squamosal portion of the zygomatic arch, although more elevated and convex than is usual in *U. arctos*, is more rounded and less angled than in the female skull in which the exceptional height of the arch at this point seems due to a special ossification attested by the suture line.

The more important cranial and dental dimensions of this race, so far as they are available, are recorded in the following table.

Locality or author and sex	Skull in English inches.						Upper teeth in mm.		Lower teeth in mm.	
	Total length	Cond. bas. length	Zygom. width	Mastoid width	Int. orb. width	Max. width	Last 3 cheek teeth	Last cheek tooth	Last 4 teeth	Penult. tooth
(Leche) ♂	14·8	...	8·8	...	...	...	...	...	88	...
,, ♂	14·2	...	8·8	...	...	...	...	...	93	...
,, ♀	12·5	...	7·4	...	...	...	...	...	87	...
Tibet (Lönnberg) ♂	14	13·2	8·7	6·3	2 8	...	79	39 × 21	88	...
Kansu (,,)	11·6	11·4	6·1	...	2·5	...	84	41 × 22	95	29 × 18
,, (Fenwick Owen) ♂	13·6	13	7·3	6+	2·6	2·8	83	41 × 22	92	29 × 17
,, (Fenwick Owen) ♀	13·3	...	8·1	5·9	3·1	2·9	77	39 × 20	86	27 × 17
N. E. of Lhasa (?) (Bower) ♀	11·2	10·7	5·9	4·6	2·5	2·4	71	35 × 17	80	24 × 14
N. of Lhasa (Elwes)	...	...	...	...	...	2·6	...	...	...	27 × 15
Lhasa (Blanford)	...	...	...	...	...	...	...	× 22	...	26 × 16

Conclusion. The general colour of this bear may be described as blackish or black with the head and muzzle palish brown, a white collar and the tips of more or fewer of the body-hairs varying, probably seasonally, from reddish buff to greyish white, the last-mentioned phrase having inspired the name 'blue bear of Tibet'! The race seems nearly allied to the so-called 'black-bears' (*lasiotus* + *yesoensis*) of Manchuria and Japan, the resemblance, apart from the white collar, between Sir C. Bell's Lhasa skin and the second of the two skins of *lasiotus* from the Zoological Society, recorded above, being unmistakable. The claws of *pruinosus* are, however, typically pale horn-coloured instead of black. The table of cranial measurements shows, moreover, that the skull of *pruinosus* is a little smaller and has relatively, generally actually, larger teeth, although their individual variation in size is considerable, as may be seen by comparing the large upper and lower molars of Bower's skull from N.-E. of Lhasa with Fenwick Owen's male skull from Kansu. Certain resemblances in colour and in the development of the collar between *pruinosus* and the little-known *collaris* were referred to above under the latter race.

THE KASHMIR BROWN BEAR.

Ursus arctos isabellinus, Horsf.

Ursus isabellinus, Horsfield, *Tr. Linn. Soc. Zool.* 15, p. 322, 1826; Adams, *Proc. Zool. Soc.* 1858, p. 517; Gray, *Proc. Zool. Soc.*, 1864, p. 686; *id. Cat. Carn. Brit. Mus.*, p. 223, 1869; and of most Indian sportsmen and naturalists.

Ursus arctus, Blanford, *Mamm. Brit. India*, p. 194, 1888.

Ursus arctos isabellinus, Lydekker, *Proc. Zool. Soc.*, 1897, p. 420.

Ursus leuconyx, Severtzow, *Nachr. Ges. Moscou*, 8, p. 79, 1873; trans. in *Ann. Mag. Nat. Hist.* (4), 18, p. 43, 1876; Noack, *Zool. Any.*, 1903, p. 642 (not *leuconyx*, Sowerby, 1920, and Howell, 1929, for which see under *pruinosus*).

Ursus pamirensis, Ognev, *Nature and Sport in Ukraine* (transl. of Russian title), p. 5, 1924.

Type locality of *isabellinus*: Mountains of Nepal.
,, *leuconyx*: Thian Shan.
,, *pamirensis*: The Pamirs.

Distribution: From Thian Shan to the Western Himalayas and probably the Hindu Kush if the reddish brown bear recorded from Afghanistan by Burnes (*Cabool*, p. 163) belongs here.

Since few systematists have had skulls and skins of this bear wherewith to busy themselves creating out of it species or subspecies on cranial and dental differences due to age, sex or individual variation or on seasonal differences in coloration, its synonymy is simple. Diverse opinions have been held as to its status, many authors considering it probably identical with *syriacus*.[1] It is in my opinion a definable and tolerably well-marked race of *Ursus arctos*, as Lydekker maintained. It has not, however, been previously detected that *leuconyx* of Severtzow is a synonym of *isabellinus*. Severtzow clearly suspected that it might be; but not knowing the colour of the claws of *isabellinus* from Horsfield's description, he separated his specimens as *leuconyx* on account of the pallid hue of their claws. These specimens came from the Thian Shan range, not from the Altai as stated by Sowerby and, following him, by Howell. This mistake by Sowerby, coupled with his unacquaintance with Severtzow's description, led him to affiliate *leuconyx* with *pruinosus* and wrongly to identify as *leuconyx* Capt. Fenwick Owen's Kansu bears, described above.

The description of *pamirensis* has little value; but since the Pamirs lie geographically between the Thian Shan and the Himalayan Ranges, there is no reason to doubt that the bears of the Pamirs are identical with those to the north and south.

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[1] In *Sport in Many Lands*, p. 342, the 'Old Shekarry' described a bear he shot in the Caucasus as belonging apparently to the same species as the hill bear of Kashmir.

The chief characteristics of the skins I have seen of this bear are as follows [1]:—

A. Specimen from Thian Shan (St. George Littledale, B.M. No 2.3.9.2).

1. An adult undated skin, no doubt in new summer coat, the hair generally being shortish and the underwool scanty. Colour tolerably uniformly brown, the hairs of the head and body dark brown basally, darker on the back than on the flanks, the tips of the hairs being paler, buffy brown with distinct sheen. Throat, breast and legs dark brown, the hairs without pale tips. Collar represented by a dirty white patch on each side of the neck. Claws pale horn-colour; on forepaw 2 ins., hind paw 1 in. long, with worn tips. Hairs mostly about 2½ ins. long, 3¼ ins. on the shoulder-mat. Length of skin 5 ft. 5 ins.

This is the first record of the occurrence of *isabellinus* in Thian Shan. How much farther north in Central Asia the race extends, is unknown; but neither the skin above described nor the skulls measured in the table below, supply any character by which they can be distinguished from Himalayan specimens.

Severtzow's description of this bear in the Thian Shan, where it occurs up to 10,000 ft., is good and interesting. The general colour, he said, is reddish-brown with yellow-tipped hairs and reddish-brown legs. But it varies locally. In the high plains of Upper Narin the hair is tolerably light basally, whitish terminally, the general tint being dirty white, with light brown legs. In the forests above Vernoe, from 3,000 to 6,000 ft., the general colour is reddish-brown, with yellow-tipped hairs. At Karatau, from 2,000 to 3,000 ft., the tint is very pale yellowish, the ends of the hairs being hardly lighter than the roots. But unless all the skins he saw were the same date—and there is no information on that point—some of the differences in colour he pointed out may have been seasonal. None of his specimens was apparently quite so dark as St. George Littledale's; and the variations in colour he described are not nearly so marked as in the examples recorded below from Gilgit, Kashmir, Kulu and Tehri Garwhal. Noack, moreover, records that a specimen imported to Germany by Hagenbeck was in April of one year, pale yellowish brown, with a broad brown band on the neck and shoulders, but when he saw it in the following year the hairs were tipped with white.

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[1] I gladly avail myself of this opportunity to express my indebtedness to Col. C. S. Bower and to Lady Lowndes for the kind loan of the two skins from Gilgit; and more particularly to Major G. Burrard, Col. C. H. Stockley and Mr. H. Whistler for generously presenting to the British Museum the skins and skulls of their specimens, upon learning from me how badly the national collection was in need of accurately localised and dated skins of this bear, the only representative of the 'brown' bear that occurs in territory under British jurisdiction.

B. Specimens from Gilgit.

2. Adult female shot in the Tilail Valley off the Gilgit road, April 15, 1905, by Col. C. E. S. Bower, D.S.O., who kindly lent it to me for description.

The coat is long, rough and tufted, the hairs uniting in separate bundles, the dark under-hair displayed between them so as to give a mottled aspect to the pelage. General colour pale greyish brown, almost dirty white under reflected light, about 1 in. of the ends of the hairs on the back and flanks greyish buff, browner on the shoulder-mat; basal portion of all the hairs and the underwool brown, deep on the back, paler on the flanks and rump. Some white hairs on the ears and a large patch of wholly white hairs on the sides of the neck, three inches apart on the nape, forming a partial collar. On the cheeks and throat, low down on the flanks and limbs the hairs are brown, the coarse hairs on the paws having a golden sheen. The hairs on the shoulder-mat are from 5 to 6 ins. long, elsewhere on the body about 4 or 4½ inches. The claws are horn-coloured throughout, 2 ins. long on the forepaw, 1·1 inch on the hind. The dressed skin measures 4 ft. 11 ins.

3. A cub, half-grown, shot at the same time and place, and kindly lent to me by Lady Lowndes. This skin is much shabbier than the last, the coat being more tufted and curly and altogether redder, browner and less grey, the pallid tips to the hairs being worn off all down the back displaying the darker basal portion of the hair and the underwool which are much paler and redder brown than in the adult. The skin measures 3 ft. 11 ins. Whether the faded and shabby look of this skin is natural or due to exposure to light and the tread of feet, it is impossible to decide.

4. Bassin, Gilgit, May 28, 1879. (Dr. J. Scully, B.M. No. 81.3.1.3.) A young skin, 4 ft. 9 ins. long, in full moult and very shaggy. The general colour much darker brown, both on the limbs and elsewhere, than in the specimens shot on April 15 in the Tilail Valley by Col. Bower, the shoulder-mat being entirely dark brown as if composed of new hair with the tips unfaded. The body for the most part patched with buffish grey showing an almost silvery sheen in certain lights; but here and there the body hairs are all brown, suggesting the breaking off and shedding of their greyish tips. A white collar on the sides of the neck, its upper ends separated by about 4 ins. on the nape. Belly, lower part of legs and paws entirely brown. Claws pallid horn colour.

C. Specimens from Kashmir.

5. An old female from Matyol village on the Shingo Shigar River, 13,500 ft., S. of the Deosai Plateau. September 1, 1930. (Col. C. H. Stockley, B.M. No. 31.2.2.1).

A long-coated, shaggy skin with a good deal of underwool, general colour rusty brown mottled with dusky greyish black owing to the exposure of the dark tinted under-hair.

Muzzle and head pale buffy brown, the concealed basal portion of the hairs of the head greyish black; ears covered with long hairs conspicuously white basally on the margin. The long hairs at least of the neck, shoulders and back with long reddish brown ends, blacker below, the extreme tips in many places quite grey and showing up with almost silvery sheen in certain lights. Rump and limbs darker brown, the hairs more uniformly tinted, those of the paws at least without pale tips. A conspicuous white collar on the sides of the neck, its upper ends separated by an area of about 8 ins. on the nape. The long hairs varying a good deal in length even on the same area, generally speaking about 4 or 5 ins. long. The underwool dark brownish on the back, fading to grey on the flanks.

6. Skin of a specimen from the Donahung nullah, Kistwar, Kashmir, presented by Major Whatman to the Zoological Gardens where it died in May 1918. (B.M. No. 19.2.14.1). The coat is nowhere matted or tufted, but has thick underwool. The long hairs everywhere brown basally with paler tips. On the shoulder-mat and forepart of the back the bases are very deep brown, the extreme tips reddish buff; elsewhere the bases not so dark and the tips are greyish buff with a silver sheen, giving a generally grey aspect to the skin. The underwool is dark brown on the shoulder-mat, paler on the rest of the back and becoming a pale grey on the flanks. Head and muzzle with greyish sheen. Paws brown with golden-brown sheen. A very conspicuous collar of wholly white hairs, its upper ends separated by about 9 inches on the nape in front of the shoulder. The hair on the neck is up to 4 inches long, on the shoulder-mat up to 5 inches, on the back 3½ inches, on the flank 5 inches.

7. Kashmir, without precise locality. Mounted skin of a young specimen received from the Zoological Society (B.M. No. 52. 3.2.1). Coat long and thick. The hair all over is deep brown at the base, with buffy grey tips, darker and not so grey on the shoulder-mat and on the mid-line of the back as on the flanks.

D. Specimens from Kulu.

8. Skin of young male from the Solang nullah, 7,000 to 8,000 ft. June 23rd, 1910, presented by Mr. H. Whistler (B.M. No. 29. 12.24.1). Coat exceedingly tufted and curly; general colour golden brown, mottled with dark patches where the dark brown bases of the hairs, which are sharply contrasted with the paler buffy tips, are exposed by the shagginess of coat, the contrast being specially noticeable on the forepart of the back and as marked as in the Gilgit skin (No. 2), but the tips of the hairs are not so grey. Tips of hairs on muzzle and forehead nearly grey. Paws dark brown, with grey sheen. Underwool abundant, paler brown than the bases of the overlying hairs. No white collar. The hair

on the nape is 4½ ins. long, on the shoulder-mat 4¾ ins., on the back 4½ ins., on the flank 5½ ins.

On the label attached to this specimen is a note by Mr. Whistler stating that, when shot, the bear was light golden yellow along the back, browner underneath. A Black bear was seen at the same time in the same nullah. The shooting of this Red bear is described in Mr. Whistler's book *In the High Himalayas*, pp.185–192.

9. Skin of an old male from the Manali nullah, in Kulu, 10,500 feet, shot in May 1931 by Capt. D. G. Lowndes who kindly presented it to the British Museum. The coat is long, thick and tufted, with abundant underwool, its shagginess giving a mottled aspect to the general coloration. Hair on the neck, shoulder and back about 3½ inches long, on the flanks up to 5 inches. General colour decidedly sepia, not reddish brown, the tips of the hairs of the back brownish buff, of the flanks, rump and thighs buffish grey, belly, fore leg and lower half of hind leg uniformly dark brown. Underwool grey, darker on the back than on the flanks, collar represented by a tolerably large area of wholly white hairs on the sides of the neck. A quantity of whitish hair on the ears; muzzle fawn brown. Claws pale horn, almost ivory-like in hue, on the forepaw up to 2⅓ inches long, on the hind about 1½ inches. Length of skin stripped but untanned and apparently unstretched, 5 feet 5 inches.

This skin, although obtained at approximately the same time of the year and in the same district as Mr. Whistler's specimen, is very much darker and browner in hue, lacking almost entirely the reddish tinge so conspicuous in that and some other skins. It also differs in the presence of the white collar. In general appearance it comes nearest to the skin from Bassin, Gilgit, but is darker.

E. Specimen from Tehri Garwhal.

10. Skin of adult, but not quite full-sized male from the Dumdar Valley, 10,700 feet, shot on May 31, 1910, by Major G. Burrard (B.M. No. 31.1.6.3). Coat in much the same condition as in the Kulu specimen, long, thick, forming long matted tufts and with abundant underwool. General colour golden brown and mottled, but the tips of the hairs rather richer coloured than in Whistler's skin, apparently less faded, and the basal parts much paler brown so that the contrast in tint between the tips and the basal parts is not nearly so sharp even on the shoulders and forequarters, although it is noticeable there, whereas on the hind quarters, the hairs are tolerably uniformly pale throughout. Head and muzzle more golden buff, less grey than in skin No. 8. Paws not so deep brown and with a golden sheen. No white collar. Claws as in the Kulu bear pale horn colour, banded with dark grey. The hair is a little shorter than in the Kulu specimen, measuring about 3½ inches on the neck and shoulder-mat, 3 inches on the

back and 4½ inches on the flank. Measured in the flesh this bear, a nearly full-sized male, was 5 feet 4 inches from the snout to the root of the tail and 2 feet 3 inches at the withers.

F. Specimen from Nepal.

11. Horsfield's typical example, said to be from the mountains of Nepal, was an undated, imperfect skin of a young specimen, measuring 3 feet 10 inches. He described it as very pale reddish brown with an obscure tint of dirty yellow or isabelline, almost uniform everywhere. The hair of the head, neck and shoulders was shaggy and curled; but on the flanks and abdomen it was short. From this description it may be inferred that the bear was killed in the spring or early summer before the moult. In colour it seems to have resembled tolerably closely Major Burrard's skin from Tehri Garwhal. So far as I am aware, this is the only record of this bear from Nepal. Probably the specimen was a traded skin from Tehri Garwhal or Kulu.

According to Adams, whose account inspired Blanford's description of this bear, the colour varies much, from dirty brownish white to dark brown, many old males being very dark brown, and is always lighter in spring than autumn. In winter and spring the coat is long, thick and shaggy; but towards autumn the underwool disappears. In the autumn the white collar is conspicuous, whereas in winter it is indistinct.

The skins above described do not altogether bear out this account, which contains no word explaining the term 'red bear' commonly applied by sportsmen to this race. Judging from the skins I have seen the term 'red' is particularly applicable to the dead and tufted winter coat, before the summer moult sets in, soon after the bear emerges from winter quarters. Major Burrard's skin from Tehri Garwhal is a good illustration. Also Col. Stockley's specimen, killed at the beginning of September, has decidedly reddish tips to the hairs on the back, shoulders and neck. Dr. Scully's specimen killed at the end of May in Gilgit is a brown bear with greyish buff tips to the hairs, but no red. Capt. Lowndes' specimen killed in May in Kulu, is also a brown bear. Sharply contrasted with these is the skin of the bear from Kistwar in Kashmir which, under reflected light, looks silvery grey; and attached to a skull from Kashmir, presented to the Museum by Lieut. Abbott, is a label describing the bear itself as 'white'. Probably it was very much the tint of the Kistwar skin. From the skins above mentioned, this bear might be truthfully described as 'grey', 'red' or 'brown'.

I cannot confirm Adams's statement regarding the collar. It is present in the Gilgit and one of the Kulu specimens in winter coat killed in April and May; traceable, but not conspicuous, in the Thian Shan specimen, evidently in new summer coat; very well marked in the Kashmir specimen shot by Col. Stockley in September, but not noticeable in Burrard's Tehri Garwhal and Whistler's Kulu specimens shot in May and June respectively. In the case of the European Brown bear the development of the collar has been associated with age. It is said to be present at all events in many cubs, but to disappear in mature and old specimens as a rule.

The following table gives the measurements of some skulls :—

	Skull in English inches.						Upper teeth in millim.		Lower teeth in millim.	
Locality and sex	Total length	Cond. bas. length	Zygom. width	Mastoid width	Int. orb. width	Max. width	Last 3 teeth	Last tooth	Last 4 teeth	Penult. tooth
1 Thian Shan, ad. ♂	13 +	12·1	8	5·8	2·9	2·9	66	34 × 18	78	25 × 16
2 Thian Shan, yg. ♂	10·6	10·3	6·1—	4·3 +	2·3 +	2·4	68	35 × 17	76	23 × 14
3 Kashmir, ad. ♂	13·3	12·3	7·2	5·9	2·5	2·8	68	34 × 19	78	24 × 15
4 ,, old ♂	13·2	11·8	7·8	6·2	2·8	2·8	71	36 × 18	77	25 × 15
5 (?) Kashmir, not ad. ♂	12·9	11·2	7·7	6·3	2·5	2·8	65	34 × 17	73	22 × 14
6 Kashmir, not ad. ♂	12·5	11·4	6·9	5·4	2·7	2·6	69	35 × 17	74	23 × 15
7 Kashmir, old ♂	12·2	11·3	7·6	5·7	2·4	2·8	64	32 × 16	70	22 × 14
8 Tehri Garwhal, ♂	13	12	7·8	6·2	2·9	2·7	69	35 × 17	77	23 × 15
9 Kulu, young ♂	11·3	10·7	6·1	4·6	2·3	2·4	70	35 × 18	77	24 × 16
10 Tehri Garwhal, old (?) ♂	11·5	10·9	7·2	5·5	2·7	2·5	...	30 × 15	68	22 × 12
11 Kashmir, ad. ♀	11·5	10·6	6·7	4·9	2·3	2·4	66	33 × 17	73	22 × 14
12 Kashmir, oldish ♀	11·1	10·5	6·7	4·8	2·6	2·4	65	34 × 16	70	22 × 15
13 Kashmir, ad. ♀	10·9	10·2	6·2	4·6	2·3	2·2	63	32 × 16	70	22 × 13
14 Kashmir, aged ♀	10·7	10	6·9	5	2·6	2·5	56	30 × 15	66	21 × 13
15 Kashmir, young ♀	10·1	9·5	5·6	4	2	2·1	65	35 × 16	70	21 × 14

Through the courtesy of Mr. R. H. Burne, F.R.S., I have also examined and measured three additional youngish skulls of *isabellinus* from Kashmir (Col. H. A. Smyth, R. A.) preserved in the Museum of the Royal College of Surgeons and one from Simla. Their dimensions, both cranial and dental, are in close agreement with those enumerated above.

By their cranial and dental measurements the two skulls from Thian Shan, presented by St. George Littledale, bear out the conclusion established by the skin, to which the adult skull belongs, that *isabellinus* extends as far north as that mountain range.

The ♂ skull (3) from Kashmir (Lieut. Abbott No. 56.9.22.21) is just adult; but it is interesting to note that the jaws (maxillæ) just above the canine are noticeably wider than the interorbital width. No. 4 (St. George Littledale), although old judging from its muscular development and the obliteration of its sutures, has exceptionally large upper teeth. No. 5 is unlocalised but is inferred to have come from Kashmir because it is ticketed Falconer (66.8.10.7). No. 6, a skull like the last with the cranial sutures open, was presented by Oldham (1010 f). No. 7 (St. George Littledale) is of peculiar interest. From its shape I have entered it as a ♂. It is old and about the same age as No. 4, which it closely resembles in form, but is considerably smaller and has the maxilla much wider than the interorbital width, even more so than in No. 3. The teeth too are

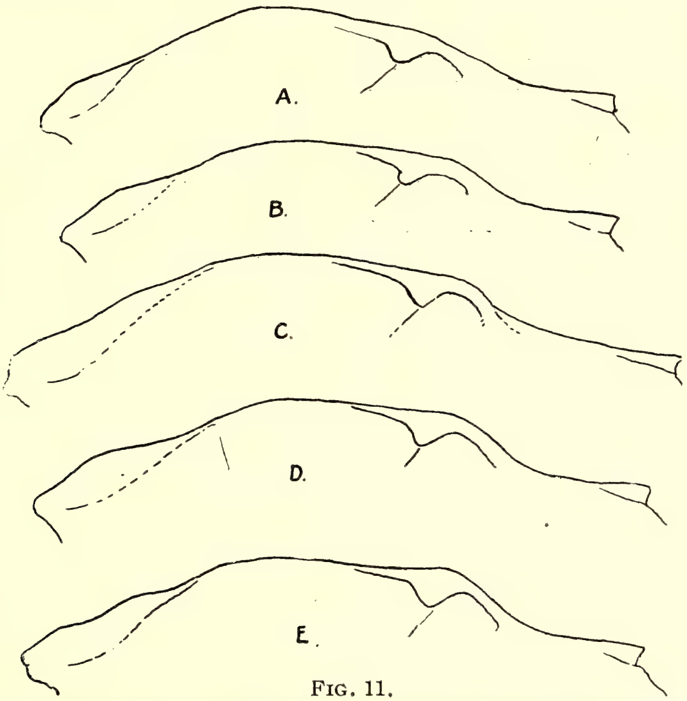

FIG. 11.

Profile variation of upper surface of skull of the Kashmir Brown Bear (*U. a. isabellinus*).
A. Old female from Kashmir (Stockley).
B. Young adult female from Kashmir (Abbott)
C. Old male from Kashmir (Littledale).
D. Old male from Kulu (Whistler).
E. Old male from Kashmir (Littledale).

exceptionally small, resembling those of the females. It may be a large and unusually well-developed female skull. No. 8 is the skull of the male from the Dumdar Valley, Tehri Garwhal, belonging to the skin presented by Major G. Burrard (31.1.6.3). Its cranial sutures are not quite closed, indicating incompletion of growth. No. 9, a young male skull from Kulu, belongs to the skin presented by Mr. Whistler (No. 29.12.24.1). No. 10 came from the Bheling Valley, Tehri Garwhal, and was presented by Capt. E. Searight (No. 30.11.1.1). It is very old with the teeth much worn. It is labelled as a male ; but is small for that sex.

Of the female skulls, No. 11 was presented by St. George Littledale (No. 87.5.5.3). No. 12 by Lieut. Abbott (No. 56.9.22.20). This is an old skull with worn teeth and is labelled ' white bear.' It is the skull figured by Lydekker, erroneously as that of a subadult animal, to illustrate the characteristic shape of the cranium in *isabellinus* (*Proc. Zool. Soc.* 1897, p. 420). No. 13, from Kashmir, presented by C. H. Donald is just adult. No. 14, a very old female skull, with the teeth worn quite flat, was presented by Col. C. H. Stockley (No. 31.2.2.1), and came from S. of the Deosai Plateau, 13,500 ft., in Kashmir. No. 15 (1010 e) is a young skull with unworn teeth.

Conclusion. By its smaller skull and teeth, apart from differences in colour, this race may be distinguished from *pruinosus*, *lasiotus* + *yesoensis*, *shanorum* and *beringianus*. The skull too is smaller than in *arctos* and *syriacus*, although the teeth are about the same actual size. But the annexed figures of the dorsal profile of the skull of *isabellinus* exhibit a more pronounced curvature from the brow to the occipital crest than is observable in the other races, the highest point being typically near the middle of the crown, although the brow, when inflated, is raised almost to that level. The curvature at its greatest is, however, very similar to that of the young male skull from the Caucasus (Fig. 8, B.) and the male skull (Fig. 11, E.) from Kashmir is not very different in curvature, as in the inflation of the brow, from the skull of *arctos* from Olonetz (Fig. 6, C.).

There is no evidence that *isabellinus* intergrades with the Tibetan *pruinosus*, whose known range is considerably to the east. But its occurrence in the Pamirs and Thian Shan, coupled with its apparently nearer kinship with the European Brown bear, suggests first, that it will be found to intergrade to the north of its present known range with bears closely related to typical *arctos* and, second, that it entered the North-Western Himalayas from the North by way of the Thian Shan and Pamir ranges. With regard to the distribution of this bear in the Himalayas, Major G. Burrard[1] states that its western boundary is the valley of Chitral and its eastern apparently the basin of the Bhagirathi in Tehri Garwhal. It is found on both sides of the great Himalayan Range and of its spurs, the Dhauladar and Pir Panjal Ranges, but in the latter it does not extend farther to the west than the Chenab River and in the former it does not occur immediately to the east of the Sutlej, nor between that river and the Beas river, its western limit in the Dhauladhar being Bara Bangahal, a basin at the head of the Ravi river.

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[1] *Big Game Hunting in the Himalayas and Tibet*, p. 209.

A few weeks after the corrected proofs of this paper were posted to Bombay, the British Museum received an interesting example of the Kashmir Brown Bear (*Ursus arctos isabellinus*) made up as a rug and kindly presented by Sir Richard Dane, K.C.I.E. whose son shot it near the Daudwar Nullah at the top end of the Kashmir Valley, close to the foothills, but actually in the plain, at a height of not more than 6,000 ft. It was in a field of Indian corn, half surrounded by the houses of a small village, and must have come, Sir Richard thinks, either from the Pir Panjal by the Konsa Nag Lake or from Kishtwar.

It is unlike any of the skins described above in its general cream or buffy white colour, resembling at a glance a soiled Polar Bear. No doubt the Kashmir Bear, referred to above, which was described by Lieut. Abbott as a ' white bear', was like it. But the whiteness, except on the muzzle, round the eyes, low down on the flanks, on the belly and on a large patch on each side of the neck, representing the collar, where the hairs are wholly white, is restricted to the terminal 1¾ inches or so of the hairs. Below that point they are rusty, turning browner at the base, so that when the coat is disarranged the pelage is mottled with darker patches. But the coat being comparatively short, smooth, untufted and provided with little underwool, the dark patches are not naturally displayed. The hairs on the shoulder-mat and flanks are about 4 inches, on the back about 3½ inches long. The claws are pale horn coloured, those of the forepaw measuring just under 2½ inches and on the hind paw 1½ inches long.

We now have complete evidence that the ' Isabelline bear ' may be white, silvery grey, red or brown, the range being from that of the Polar Bear to that of the dark brown European Bear.

The skull is that of a young adult male of the typical ' high browed ' type. It is larger than any entered in the table, measuring 13·6 inches in total, and 12·6 inches in condylo-basal length, with a zygomatic width of 7·7 inches. Its length is just about equal to the largest for this race entered in Rowland Ward's Records for 1928. The teeth are average size.

(*To be continued*)

SOME BEAUTIFUL INDIAN TREES.

By E. Blatter, s.j., ph.d., f.l.s., and W. S. Millard, f.z.s.

Part IX.

(*With one coloured and one black and white plates and 2 diagrams.*)
(*Continued from page 529 of this volume.*)

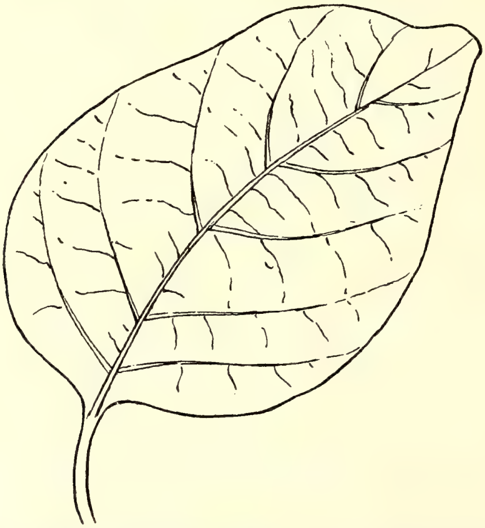
The Scarlet Cordia or Aloe-wood.

Popular Names : Sebesten Tree, Geiger Tree, Scarlet Cordia.

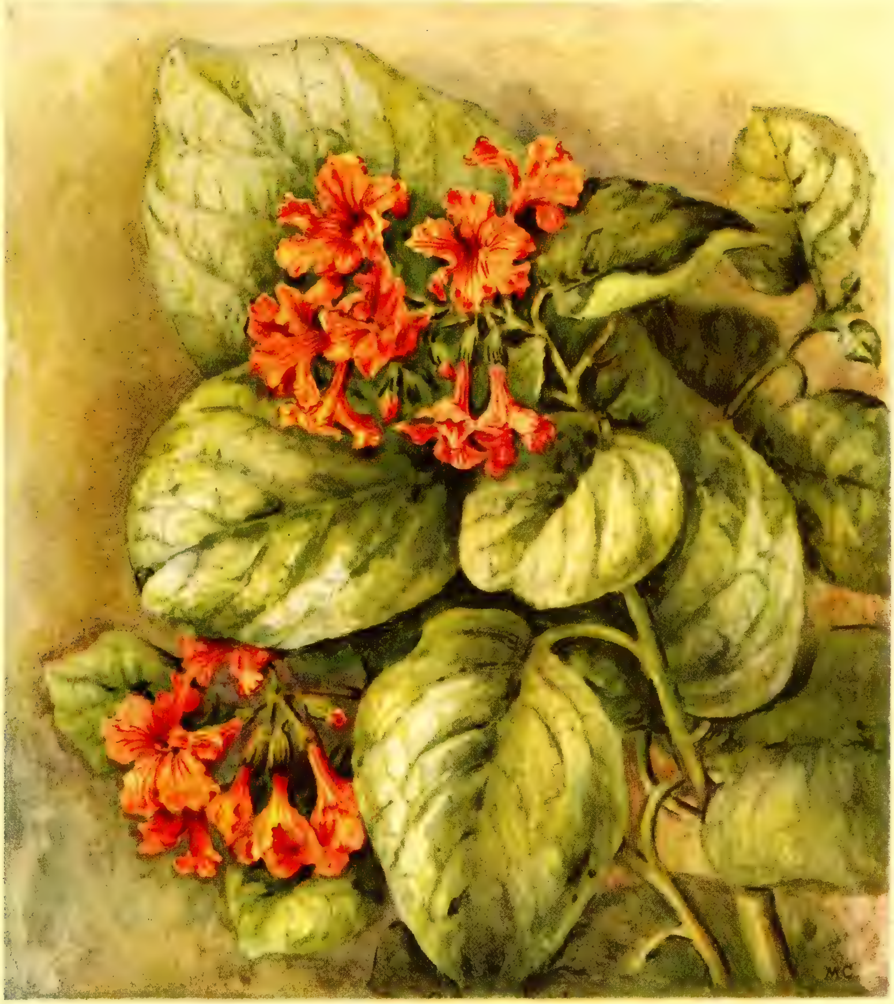
Cordia sebestena Linn. Sp. Pl. (1753) 190. (Boraginaceæ ; Borages). (Named *Cordia* after Valerius Cordus, an early German botanist, born 1515 ; *Sebestena* means having fruits like sebestens, and sebestens is derived from the Persian Sapistan given to the fruit of an allied species, which grows in the neighbourhood of the town Sebesta.)

The genus contains about 230 tropical and sub-tropical species, mostly American ; some are vines, some herbaceous, some yield drugs and others useful timbers and others again bear edible fruits. The fruit of a common Indian species, *Cordia myxa*, is used in medicine under the name of *sebesten* or sepistan, a term which as we have indicated above, gave the specific name to the present species.

The tree is rendered conspicuous in gardens by its bunches or clusters of beautiful orange-scarlet flowers which appear practically at all seasons of the year.



Description : A tall evergreen shrub or small tree, growing from 15–30 feet in height. The leaves grow alternately on the branches. They are from 4–6″ in length, large, oval or elliptic in shape and blunt at the apex. The leaves are rough to the touch, being much wrinkled, furrowed above and heavily ribbed below. Young plants in fresh verdent green leaf are very handsome. The showy orange-red flowers appear in large open clusters at the ends of the branches. The flower is funnel-shaped, its tubular portion is enclosed for half its



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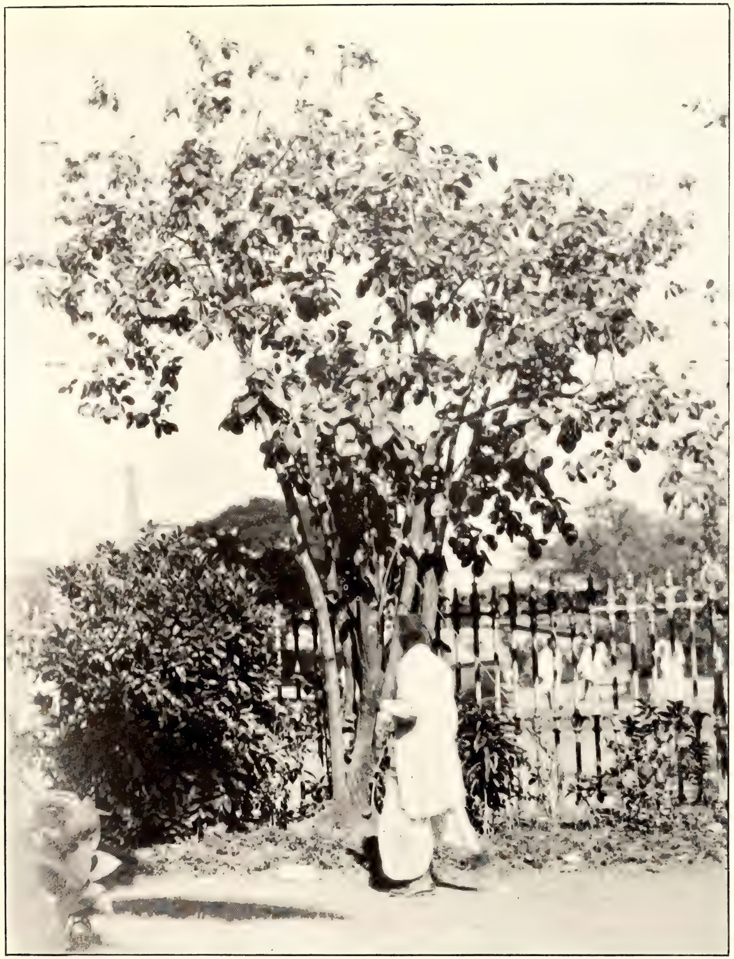
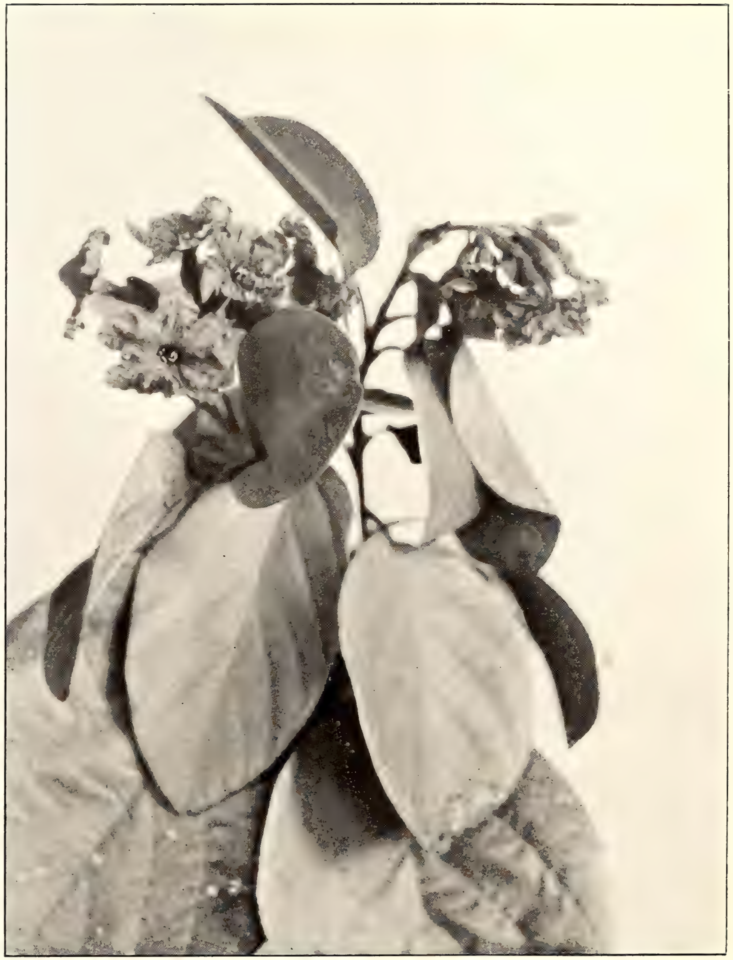
THE SCARLET CORDIA OR ALOE-WOOD

Cordia sebestena, Linn.

(about ½ nat. size)

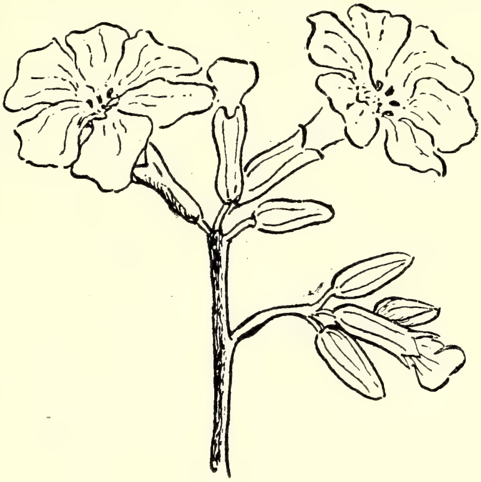


Scarlet Cordia Tree (*C. sebestena*) in the Elphinstone Gardens, Bombay.



Flowers of the Scarlet Cordia (*C. sebestena.*)

length in a heavily ribbed green calyx. Its petals are 6, rounded and heavily wrinkled. There are 5–12 stamens crowned with dull yellow elongate anthers which do not protrude beyond the mouth of the corolla. The fruit is $1\frac{1}{2}$ by $\frac{3}{4}''$. It is pure white and enclosed in a hazel-like husk formed by the persistent calyx.



Flowering Season: January–March. But the tree will be found in bloom throughout the year.

Gardening : Propagated by cuttings of firm wood and by seeds.

Native Country : Cuba.

(*To be continued*)

THE SHELL-FISHERIES OF THE BOMBAY PRESIDENCY.

REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY'S SURVEY.

BY

HARDIT SINGH RAI, M.SC.,

Royal Institute of Science, Bombay.

(*With 5 plates and 2 text-figures.*)

'Shell-fish' as a source of food from the sea are only second in importance to true fish. 'Shell-fish' are utilised in the maritime provinces of India to an extent scarcely appreciated by most people. Shell-fisheries are carried on along a considerable portion of the Bombay coast, and in some places attain considerable proportions. In general, the chief fisheries are located in the neighbourhood of large towns and are carried on by the local fishermen for local markets.

I use the term 'Shell-fish' in the wider 'commercial' sense, and as such not only include true 'Shell-fish', (Molluscs) such as oysters, clams, cockles, sea-mussels, and cuttle-fishes, etc. but also marketable crustaceans such as prawns, crabs and lobsters.

During recent years, there has been a great advance in the development of shell-fish industries in western countries, and extensive industries have sprung up in all the maritime countries of the World, such as Japan, Great Britain, France and the United States of America.

On the Bombay coast, the industry has been completely neglected and undeveloped owing to the absence of any organised agency to look after its interests. Yet there are great possibilities for the development of Shell-fisheries in our waters.

There is an ever-increasing demand for oysters, lobsters, crabs, clams, and prawns, but the supplies unfortunately are not equal to the demand. The capital required for these fisheries is comparatively small.

Bombay, with its lengthy coast line (over 1,300 miles) and its numerous creeks and backwaters, known to produce excellent and varied forms of shell-fishes, providing an annual yield estimated at 30 lakhs, offers a very attractive field for fishery enterprise. The economic and the academic value of none of these shell-fishes has yet been realised, and nobody seems to have fully worked out the life history of any of the important shell-fishes found along the Bombay coast.

Unfortunately, the public has not yet realised the great food value of some of the shell-fishes. 'All shell-fish have the property of storing great quantities of glycogen, or animal starch, and of fat, which renders them in the highest degree nutritious, and they are, moreover, rapid growing and prolific animals—capable of extensive fishing which could be greatly increased by judicious farming'.—(C.M. Yonge, 1928.)

One of the factors which has prevented the greater and more general use of shell-fish as food among the higher classes is the prevailing fear of diseases, such as enteric fever, or gastric poisoning which may result from their consumption.

Greater attention should be paid to the outflow of sewage in the vicinity of shell-fish beds than has hitherto been done in India. Many shell-fish, especially oysters, clams, and mussels are liable to bacterial contamination, and, if taken from a locality heavily laden with sewage, especially when consumed raw, or lightly cooked, may cause enteric fever and other grave disorders. In the present report I have included certain measures which could be employed to obviate such contamination.

Scope of Survey.—Early in 1930 the attention of the Bombay Natural History Society was drawn by the present writer to the desirability of making a general survey of the Shell-fisheries of the Bombay Coast including Sind. In consequence of this representation, the Society deputed the author to carry out the proposed investigation and to report on the existing conditions of the Shell-fishing Industry on the Bombay Coast. The Society willingly agreed to bear the entire expenses involved in the inquiry. The Government of Bombay gave their help by granting every possible facility in the proposed investigation.

The main object of the survey was :—

(*a*) To discover the principal species which formed the basis of the local Shell-fisheries.

(*b*) To study and report upon the economic conditions under which these fisheries were being carried on and to suggest such measures as might tend to their improvement.

(*c*) To make collections of Molluscs and other Marine Invertebrates for purposes of study and research.

The lines on which the work was to be carried out were briefly as follows :—

1. Shell-fishes used as food, their food value and other purposes.
2. A survey of local conditions.
3. Physical conditions of the beds, habitat, etc.
4. Possible income, sale, transport, etc.
5. Fishing methods.
6. Sewage problems.
7. Possibilities of the industry.
8. Measures tending to the improvement of the industry.

It is my intention in the present report to deal mainly with the economic aspects of the problem. Such scientific results as may arise from the present investigation must be left aside until fuller opportunity is forthcoming for a detailed study of the material now made available. It is hoped, therefore, that the following reports, dealing, as they do, with the economic conditions of the Shell-fisheries of the Bombay Coast may prove of some value and I trust that such recommendations as are made may help in the economic development of the industry and tend to the betterment of the fishing population of the coast.

The most suitable time to carry out the investigation would have been during the months of November, December, January and February, which constitute the chief fishing season along the West Coast. But my services were only available during the months of March, April and May 1930. The survey was started on March 2, 1930, and about 3 months were spent in visiting the important fishing centres to collect material and data necessary for the investigation. The time spent on tour, the localities visited, and Shell-fish collected, are given in Appendix II.

No previous investigation of this nature dealing with the area to be explored had been carried out and no information was available to provide a basis of the work. There were no records to indicate the species available at the different localities, the area of their distribution or the season of their abundance. Moreover, the work had to be carried out single-handed and the time and the funds at my disposal did not permit of anything more than a general study of existing conditions. But the material collected and the data obtained are sufficient to enable me to make some contributions to our knowledge of these fisheries and to provide information which can be made a basis for their improvement.

AREA SURVEYED.

Sind.—In the middle of March I went to Sind and visited the following localities :—

1. Karachi Harbour
2. Manora Islands
3. Maurypur
4. Bram Haidri
5. Piti Creek
6. Kharanji Creek
7. Khudi ,,
8. Khanto ,,
9. Pitiani Creek
10. Dubba ,,
11. Phity ,,
12. Kajar ,,

The Customs sailing yacht *Mary Queen* was very kindly placed at my disposal by the Customs authorities, and I was also able to benefit by the invaluable services of the Preventive officer who acted as my guide. More than a week was spent in the creeks to acquire first-hand knowledge of the physical and biological conditions prevailing in the Sind creeks. I visited all the important places where Shell-fisheries (Prawn and the Oyster fishing) are carried on along the Sind Coast.

Bombay Coast.—For convenience, the Bombay Coast (excluding Sind) may be divided into two regions (*a*) the Northern field, which includes districts north of Bombay (*i.e.* Surat, Palgarh, and Thana districts). The (*b*) Southern field includes Colaba, Ratnagiri and the Konkan districts.

The following localities were visited in the Northern field :— Cambay, Pardi, Arnala, Boisar, Bassein, Borivili, Varsova, Mahim, and Thana. The chief fishing centres in the North are Palgarh, Arnala, Bassein, Varsova and Mahim and the chief fisheries carried on are those of Prawn, Oyster, Crab and Lobster.

In the Southern field I visited the following localities :—

1. Rewas
2. Alibag
3. Ratnagiri
4. Jaytapur
5. Vizaydrug
6. Malwan
7. Vengurla
8. Karwar
9. Kodibag
10. Ankola
11. Kumta
12. Honavar
13. Sanikatta
14. Gokarn
15. Harwada
16. Moorba

SPECIES OF ECONOMIC IMPORTANCE.

Every creek and backwater bordering the coast of Sind has, to a greater or less extent, a shell-fish industry. A very extensive and profitable trade is carried on in Prawns, Crabs, Lobsters etc. Sind is famed for its edible oysters. In Karachi and up-country towns the demand for oysters is so great that the supply is unable to meet it. Sea mussels and cockles are also found in certain localities but they are not commercially exploited. Other shell-fish which supplement the industry are *Placuna placenta* (the Window-pane Oyster), Cuttle-fishes, and Squids.

To the South of Bombay—Alibag, Ratnagiri, Jaytapur, Malwan, Vengurla and Karwar comprise the main shell-fish-producing waters. The chief products of the Shell-fish Industry of the South are the edible oyster, clams, prawns, crabs and lobsters. Bombay possesses a fine clam (*Tapes*, *Meretrix*) industry and produces over 4 million pounds of clams each year. In addition to these, many other marine molluscs are utilized, including the following :—*Mytilus Solen*, *Venus*, *Arca*, *Umbonium*, *Purpura*, *Natica*, etc. The most important of the Cephalopods are *Loligo*, and *Sepia*, which are found all along the coast in fairly large numbers. Crustaceans (prawns, crabs and lobster) form the largest and the most valuable shell-fish along the Bombay Coast.

Shore collection was made on all occasions from the different localities visited. The collection made is large, and has been sorted out, labelled and will be placed in the Society's Museum. The most important forms collected are the following :—

Ostrea (edible oysters), *Placuna placenta* (window-pane oyster), *Tapes*, *Meretrix* (clams), *Mytilus* (sea-mussel), *Cardium* (sea-cockle), *Pecten* (comb-shell), *Arca*, *Dosina* (cockles), *Purpura*, *Umbonium* (whelks), *Cypraea* (cowries), *Cephalopoda* (squids, cuttle-fish, etc.), prawns, crabs, etc.

I propose to divide the report in two parts. The first part will deal with the molluscan shell-fish and will include the following forms, Clams, Oysters, and other minor shell-fishes (including Bivalves, Gastropods and Cephalopods). The second part will deal with the crustacean forms and will include the prawns, lobsters, and crabs.

In the following pages an attempt is made to bring to the notice of the public and the Government, the great economic value of the Bombay Shell-fisheries, and to show the present position and the future prospects of the industry. Everything possible was done to obtain reliable information and correct statistics, but for such a vast field of inquiry some allowance must be made for errors.

I desire to express my great appreciation to the Bombay Natural History Society of the honour done to me by entrusting me with this enquiry.

My greatest indebtedness is due to Mr. S. H. Prater, C.M.Z.S., M.L.C., Curator, Bombay Natural History Society, for his generous assistance and advice in all matters pertaining to this inquiry and for the great help he rendered in reading through the manuscript.

I wish to express my best thanks to Prof. P. R. Awati, I. E. S., of the Royal Institute of Science, Bombay, for his kind permission to make a survey of the Shell-fish industry of Bombay and to work in the Institute Laboratory. Moreover, I am grateful to him for the keen interest he showed in this work.

Finally, I take this opportunity to thank the officers of the Salt Revenue Department, and of the Revenue Department for the trouble they took to assist in every possible way in the present inquiry and for the help they have given at times by placing their personal knowledge of the subject, at my disposal. I would specially thank Mr. H. T. Sorley, M.A., I.C.S., Collector of Salt Revenue, Bombay, and the Collector of Customs, Karachi, for the great assistance I received through their departmental officers in my investigation.

I

BOMBAY CLAM INDUSTRY.

The Bombay Clam Industry is of great economic importance due to the following facts : (1) Clams provide cheap and nourishing food (2) they are sufficiently abundant, and form a source of supply during the monsoon when fish is scarce and (3) clam-fishing gives employment to a very large number of people who gather them for the market.

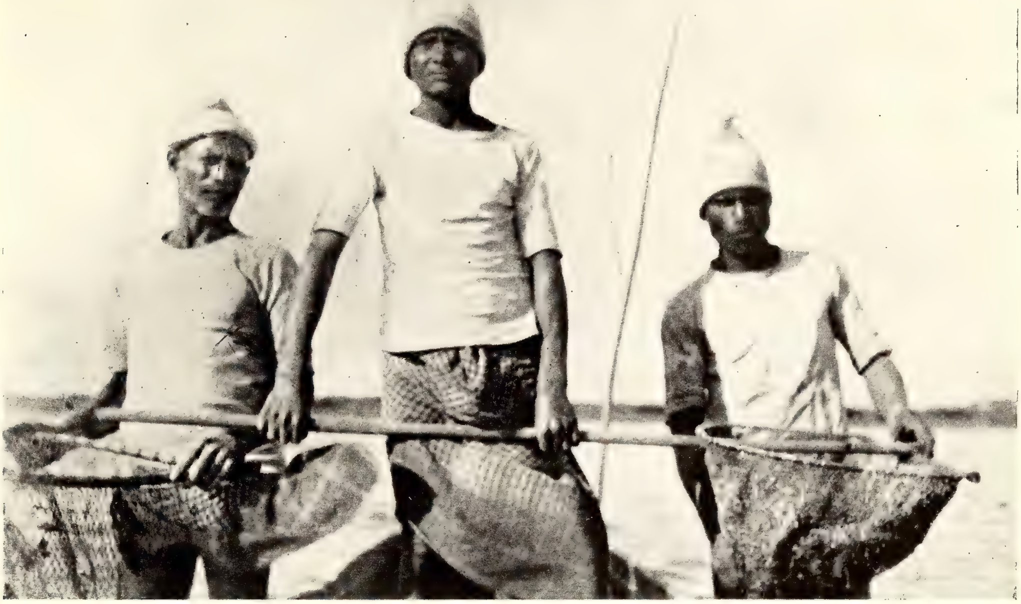
'Clams' form a popular diet among the poor people living along Bombay coast. They are prized by the fishermen above all other food molluscs except the oysters. They are chiefly used in curries, especially during the monsoon when fish is scarce, and are much valued because they are cheap and tasty. The usual retail rate varies from 2–3 pies per pound in the Bombay markets and in the mofussil a pie's worth is sufficient to make a good curry for a whole family. Though Clams have been used as food for ages, and though commonly eaten by the poorer classes, they are not very popular with the well-to-do Indians. The fishermen use these shell-fish all the year round.

Bombay clams.—Two important clams are found along the Bombay coast.

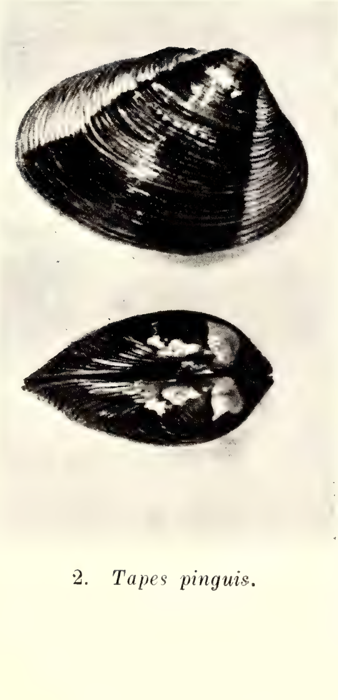
(1) Tapes.
(2) Meretrix.

1. *Tapes.* In commercial importance, the *Tapes* stands first among the true shell-fish of the Bombay coast. It is a brackish-water mollusc and has a wide distribution from Bombay to the South all along the coast. There are very few creeks in the south where this clam is not found. This is due to the excellent nature of the creeks with their large stretches of clean sandy ground. It also lives in deeper waters (one to three fathoms) and in many localities often remains submerged under water. It is found in sand but as frequently in areas where the sand is mixed with considerable quantities of mud. The most favourable place for *Tapes* beds is a sandy bottom with a little mud—too much of fine mud destroys them. They are readily injured by high temperature. In most of the creeks where the beds are exposed under low tide for a long time during the summer months, they are killed in large numbers.

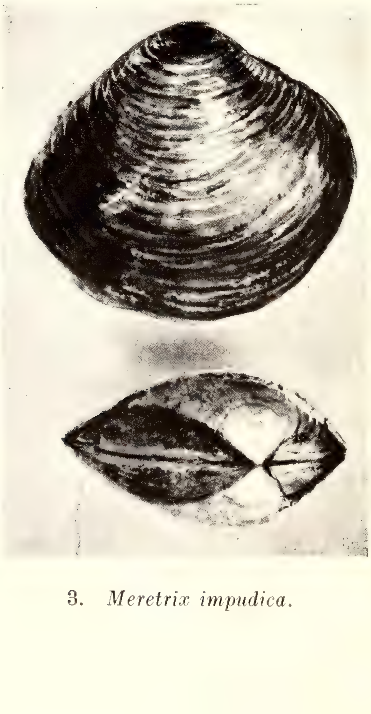
2. *Meretrix.* This clam has the same habitat as the *Tapes* and is generally found in the same beds. Its flesh has a fine flavour and is



1. Fishermen with 'Clam net' hauled out (Mahim).



2. *Tapes pinguis.*



3. *Meretrix impudica.*

nutritious. The shell is thick and massive. The average size in the adult stage varies from 60 mm. to 70 mm. with a weight of about 4 ounces. There are many species of Meretrix found all along the coast, two of which are very common, *M. impudica*, and *M. meretrix*.

Life history :—The life history of the clam is very interesting. The male and the female products, when ripe, are discharged in the water where they unite. After fertilisation the larva passes through the trochopore and veliger stages. The length of the swimming period of the larva varies according to the temperature of the water. In favourable weather conditions it takes 5–8 days for the embryo to settle down. The tiny little clam attaches itself to shells, pebbles, sand grains or sea weeds by means of a secretion from the foot, which is known as the byssus. When the foot is sufficiently developed, the clam burrows into the sand and remains buried there for the rest of its life. It grows to the adult size in about 2 years. The principal breeding season lasts from March to to June; but, if weather conditions are favourable and the temperature high (above 82°F.), they breed all the year round, except during the monsoon.

Distribution of the clam beds :—Clams occur in large beds in many localities along the Bombay coast. Bombay, Alibag, Ratnagiri, Jaytapur and the North Kanara District possess the most important clam fisheries. In some creeks, like Ratnagiri, Jaytapur and Kodibag (Karwar), hundreds of acres of calm beds are exposed under the low tide.

In North Kanara District, the beds are more numerous than elsewhere and they are also very extensive in area. *Tapes* and *Meretrix* occur in such abundance in North Kanara that an important industry has arisen as a result of which a considerable number of hands are always kept employed. The towns possessing important clam fisheries in Kanara district are: Karwar, Kodibag creek, Ankola, Moorba, Wadgoni creek, Mirgan, Harwada, Mudgian, and Sanikatta.

I estimate the area covered by clam beds at 350 acres in Kanara district and about 300 acres in Ratnagiri district, and other minor beds all along the coast may be put down at 250 acres. Altogether, there are not less than 900 acres of clam-bearing sands in the whole Presidency.

To the north of Bombay there is practically no clam industry because the shore is rocky and muddy and the grounds are not suitable for the growth of clams. Along the Sind coast these shell-fishes are absent so that there is no such industry along the Sind coast.

Value of yields :—The Kanara clam industry ranks first on the Bombay coast and the annual production from the different beds may be estimated above 2 million pounds. The Bombay markets are supplied from the Mahim creek and other creeks to the south of Bombay, the market depending chiefly on Alibag for its supply. Very large quantities of clams are consumed in Bombay. The annual consumption may be estimated to 190,000 pounds valued at Rs. 50,500.

These clams were, at one time, much more abundant along the Bombay coast. Thirty to fifty years ago the southern creeks were full and the beds crowded with them. With the increase in demand from the larger towns along the coast and the mofussil and the consequent ruthless exploitation of the clam beds, and with no State control over the fisheries, the supply has steadily diminished and clams are becoming scarcer and scarcer every year.

The crop varies from year to year, there are some good years and some lean. From my inquiries among the fishermen I am led to believe that poor yields may be due to excessive rainfall. When the creeks are continuously flooded with fresh water brought by the streams in the monsoons, the clam beds are affected to a large extent since the shell-fish die on account of the greatly reduced salinity of the water present over the beds. When the rains are normal the beds produce fairly good harvest.

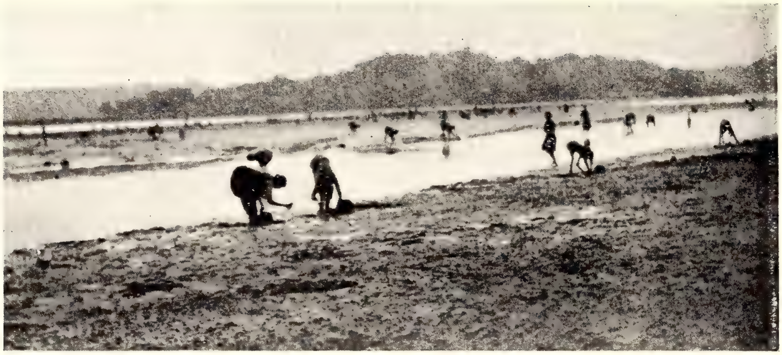
It is difficult to estimate the productiveness of these beds. One naturally expects the official records to say something about them, but no such information is available. On account of this, an exact estimate of clams collected along the coast, is impossible. However, at a general estimate, the total production of the Bombay coast may be placed approximately at 4 million pounds and the approximate value of the clam industry may be placed at Rs. 1,02,000.

Marketing :—The clams are generally marketed alive. They are also sold with the shell removed. The shells are broken against a stone and the meat is extracted with a push of the thumb, and dropped into an earthen pot containing a little of fresh water. Clam-meat absorbs a large amount of water so that it increases in volume by about a third of its original size. That is why the clams are generally soaked in fresh water before being marketed. After satisfying the local demands they are sent to the interior towns.

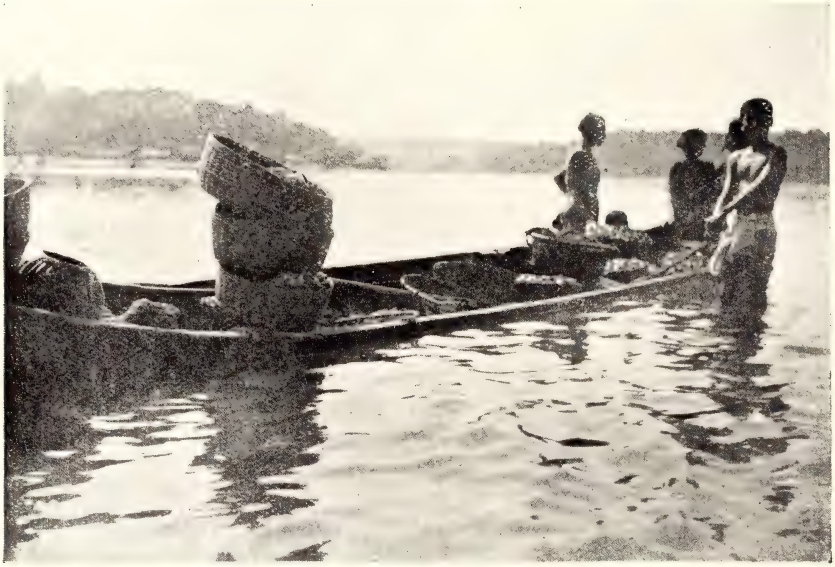
The commonest method employed for preserving clams for the market is to boil them for about 20 minutes. This causes the clams to gape. The meat is then shaken out and dried, and in this condition, forms a very delicious food, particularly during the monsoon, when fish is not readily available. The other method which is also very common, is inserting a sharp instrument, a ‘ Clam Knife ’, between the shells and pressing them aside, the soft parts are then easily scooped out. The large clams are opened by this method, while the smaller ones, which also form a part of the catch are boiled and the stew or boiled water is used in curry. The boiled meat does not smell and is eaten when dry. It is sold at the rate of 5–6 annas a pound, while the dried meat is cooked or is used in curry and is sold at annas 4–5 a pound.

By-products:—Large heaps of clam shells are met with all along the coast wherever the clams are found in abundance. The shells are sold to the lime burners, who burn them in kilns and produce a good quality of lime used extensively for whitewashing purposes.

Sewage problem :—Clams are much more liable to bacterial contamination than any other Shell-fish. The oyster beds may be established far from the shore where there is little danger from contamination from the sewage. But clams are found chiefly in backwaters and creeks, so that there is greater danger of their contamination by polluted waters. The beds which were known to produce good clams have become quite barren as a result of sewage accumulations in the neighbourhood. The fishing grounds



1. 'Clam' fishing at low tide at Jayatapur.



2. 'Tony' full of 'Clams' after fishing at Jayatapur.

3. 'Clam' fishing in deep water at Kodi-bag, Karwar.

which have survived destruction in this way are those situated near the middle of the creeks where the water is deeper, and the currents more strong.

In Mahim Creek (Bombay) where the clams are gathered in large quantities for the Bombay markets, the sewage conditions are even worse. The sewage gutters from Bombay city open into the creek. The clam beds which once produced excellent quantities of clams are now destroyed by the soft odorous mud brought along with the sewage. The conditions are so bad that there is every danger of contamination of the beds. A large amount of clams which are gathered and collected from this foul creek are sent to the Bombay markets.

Fishing Methods:—The fishing is generally done at low tide, when a large area of the beds is exposed. The work is done to a large extent by women. Each woman on an average collects about 10–12 lbs. of shell-fish, worth about 3 annas, per day.

Two methods of digging clams are commonly employed on the Bombay coast: (1) 'Dry Digging', (2) 'Wet Digging'.

1. 'Dry Digging' is carried on only when the waters have receded and it lasts only for a few hours every day. The instrument usually employed for digging consists of an iron prong with a wooden handle attached to it. The clam-collectors however use all sorts of diggers, such as cocoanut shells and iron levers at different places along the coast.

2. 'Wet Digging' is employed when the clam beds are covered by water even at low tide. A small boat and a 'Clam rake-net' are required for the purpose. The fishermen generally take their boats into 4–5 feet deep water where they can use their 'rake-nets'. The boats are anchored when the fishing ground is reached. The men wade into the water over the clam flats and locate and dislodge the clams by groping with their feet. The rake net is worked into the sand and mud, and then drawn up with the catch. It is washed repeatedly to rid it of the sand and mud till only the clams are left in the net. These are emptied in the boat, where they are sorted at leisure.

The structure of the 'rake-net' is very simple. The rake which consists of a semi-circular wooden rim has a diameter of 1½ feet. The net with a mesh of about ½ inch is attached around the rim. A long bamboo fixed across the rim serves as a handle to work the net into the sand and mud. In deeper waters clams are fished by diving.

In some southern creeks (Belleykeri) a slightly different type of rake-net is used. The rake is without the bamboo handle; instead, a number of strings are attached to its rim bearing small wooden floats. This type of net is generally used in deeper water. The fishermen dive and fill up the net with clams along with the sand and, coming up the surface, haul up the net.

Clam-farming:—No clam-farming is practised along our coasts except that in certain localities 'seed' clams are collected from different beds and planted in suitable tidal flats, where conditions are very favourable for their growth. There they usually grow to marketable size within a year or so. In Bombay (Mahim creek) the clam beds are generally stocked with seed clams from different localities (e.g. Alibag, etc.). The Mahim creek beds are very favourable to their growth so that in a year or so the seed clams are ready for market. Large quantities of clams estimated to amount to 250,000 pounds per annum valued at Rs. 1,200, are sent from Alibag for Bombay markets.

Suggestions:—The reader may judge from the foregoing description that the clam industry is very important from an economic point of view. Clams provide food for a large number of people and, as such, have a distinct value in the food market. However, for want of scientific and legislative control, the industry has been left undeveloped and allowed to deteriorate. Regulations for control would go far to place the industry on a better footing, to reduce wastage and needless destruction, and to extend the possibilities of its development.

The following measures may be adopted :—

(*a*) *Legislation.* Laws against indiscriminate fishing.

1. *Size limit.* A minimum size below which clams may not be fished or marketed should be legally enforced and this may apply to Bombay and all districts south of Bombay. The minimum size may be fixed at 1½ inch in length. This would afford the clams a chance of spawning at least once before they were fished out for the market. Such protection would save the clam beds from exhaustion. Thus when the clams are under the proposed marketable size, clam fishing would stop automatically. During this time the beds will be left undisturbed and the clams will get time to grow and spawn, and the fishing will again become abundant.

2. *Close season.* The fishing should be suspended during the summer months (March to June), the main period of the spawning season.

(*b*) *Scientific measures.*

1. Further investigation is necessary into the life history, the breeding seasons, time of maturity, rate and conditions of growth, enemies, food, etc. to provide preliminary data essential to the institution of measures for increasing the clam supply.

2. Institution of cultural methods, and the adoption of clam planting on barren and depleted grounds.

II

OYSTER INDUSTRY.

From time immemorial oysters have been considered a delicacy ; as such they are highly prized. It has been proved by many experiments that oyster flesh has a very high food value, as it contains a very high percentage of glycogen and nitrogenous compounds. The oyster is rich in Vitamins and Iodine ; both, essential constituents of human diet. Few articles of food are more nourishing than the edible oyster, but its chief merit lies in its being easily digested. Another good point regarding it is that the oyster possesses a great stimulative property, and acts as a tonic to the consumer.

BOMBAY OYSTER INDUSTRY

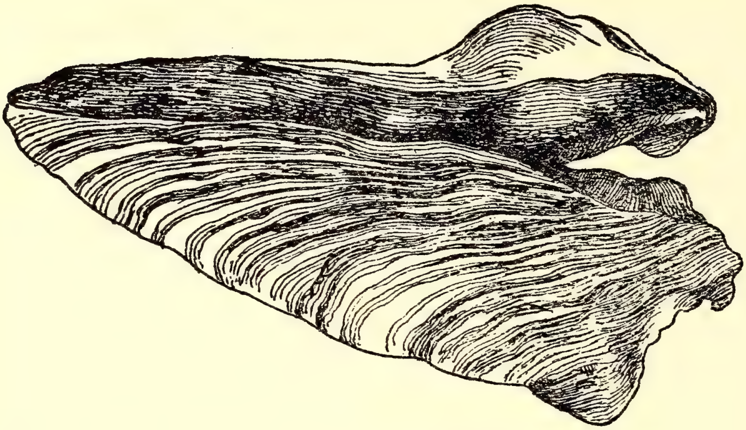


Fig. 1.—Shell of *Ostrea gryphoides* (Sch.) $\frac{1}{3}$ nat. size

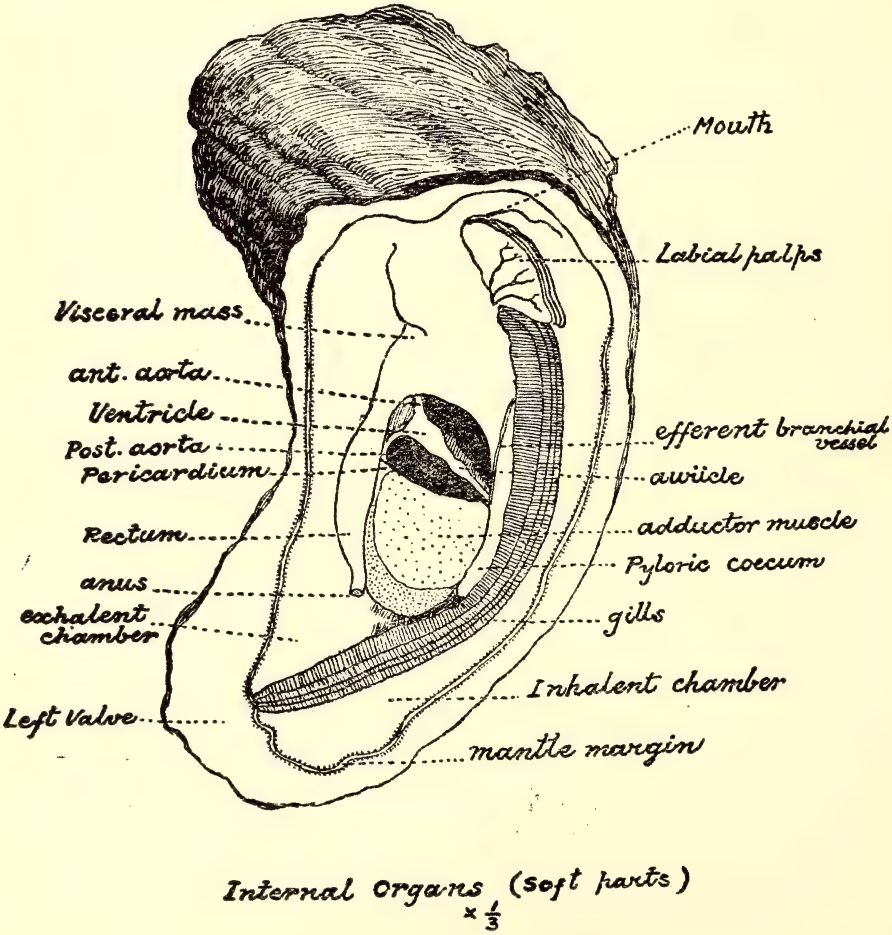

Mouth
Labial palps
Visceral mass
ant. aorta
Ventricle
Post. aorta
Pericardium
efferent branchial vessel
auricle
adductor muscle
Rectum
Pyloric coecum
anus
exhalent chamber
gills
Inhalent chamber
Left Valve
mantle margin
Internal Organs (soft parts)
× $\frac{1}{3}$

Fig. 2.—anatomy of *Ostrea gryphoides* (Sch.)

Unfortunately the better class Indians do not make use of this excellent food found along our coast, and only the Europeans appreciate the oyster. The poor and lower class people living on the shore also make use of this most valuable article of food.

Species of Economic value :—About 7 or 8 species of edible oyster are found along the Bombay Coast : of these, the following three are important from the economic point of view :—

(1) *Ostrea gryphoides* (Sch.).—Newton and Smith. (Plate III.)

This is a large oyster growing to about 6–7 inches. The rate of growth is very rapid. The oyster attains marketable size in 3 or 4 years. It is found in the muddy creeks, where it is restricted to the low-tide area. It is sometimes found in fairly deep waters—up to three or four fathoms. This oyster is valuable because it grows to a large size (some oysters in my Sind collection are from 12 inches to 15 inches in length) and can be easily cultivated. It thrives in nearly every estuary and backwater along our coast.

Distribution :—The chief centres where this oyster is found are : Sind—Karachi harbour and Sind coast (Hub-river, Kharanji, Khudi, Khai, Pitiani and Dubba creeks).

Bombay and Suburbs.—The location of the natural oyster beds are :—Malad, Boisar, Satputi Creeks, Palghar, Sanjam Kalve, Dahisar, Navapur, and Mahim.

To the South of Bombay :—Alibag, Ratnagiri, Jaytapur, Malwan, Vengurla, Goa (Portuguese India), Karwar, Gangawali Tadri and Honavar.

Other places where these oysters are found along the West Coast are :—Cutch creeks, Okha Port, Dawaraka and Porebunder.

[1] (2) *Ostrea cucullata* (Born.).—A rock oyster, found in clusters on rocks exposed at half tides. It seldom exceeds three inches in length. This oyster seems to be a slightly brackish-water form. This species ranks next to *O. gryphoides* (Sch.) in commercial importance. It has a very delicate flavour and is therefore highly esteemed.

Distribution :—It is found along the rocky coasts in the high-tide area. It has been collected from the rocks all along the Bombay coast.

(3) *Ostrea discoidea* (Gould) or *O. rivertans*.—(Plate IV). This is a flat large oyster, almost round in shape. The external surface is laminated and the lines of growth are conspicuous. The muscle scar is oblong and has a dull white colour and stands out clearly from the nacreous interior of the valves. Its shell is generally encrusted with algæ. It is more a deep-water form and grows to 6 inches in size.

Distribution :—It is found in the littoral zone at Karachi and in the Sind Creeks, Dwarka (Kathiawar), Bombay (Mahim), Ratnagiri and Jaytapur.

Other species of oysters which are not mentioned above are rare and smaller in size. They may, however, be interesting from the standpoint of the study of their Bionomics, but they are useless at present for commercial purposes.

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[1] Awati, P. R. and Rai, H. S. (1931).

Karachi and Sind Coasts. Till the beginning of the present century, the Sind creeks produced edible oysters in great abundance and Karachi was known for the excellence of its oysters. The oyster industry before 1894 was not under official supervision and no customs dues were paid prior to this period. The trade in edible oysters began in about 1885. First, the demand was purely local and there was no difficulty in meeting it. The oysters were mostly fished from Karachi backwaters (Maripur and Nawa Nar oyster beds), where large beds existed before, and are now practically non-existent.

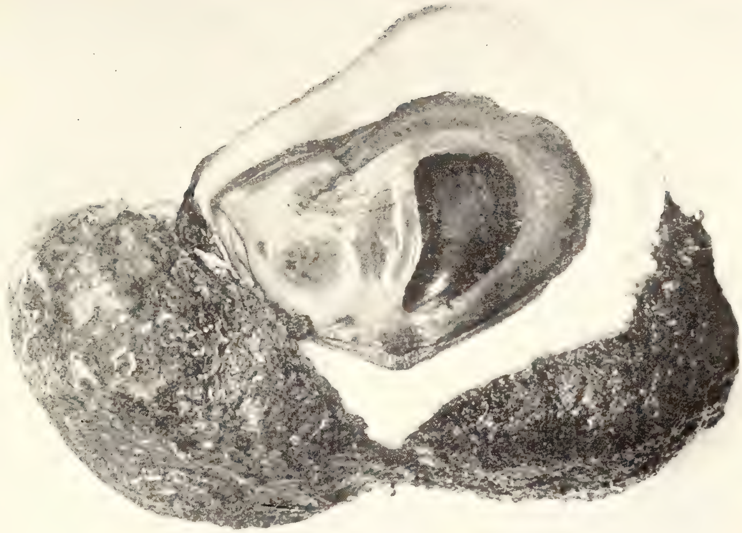
The oyster beds in the Sind creeks were so rich 'that till 1893 no difficulty was experienced in meeting the large and increasing demand'.

The customs authorities estimated the annual yield of the Sind beds during the fat years of the early nineties at 100,000 dozens.

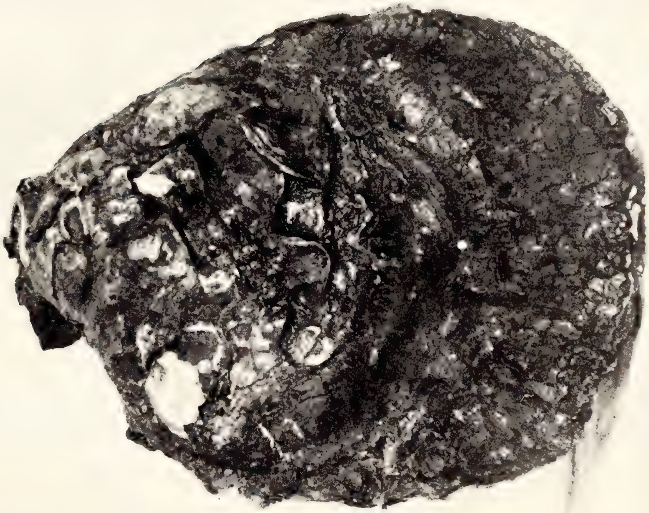
The moderate supply from the local beds was insufficient to meet the increasing demand for oysters in the Punjab, N.-W. F. P., Baluchistan, which was made possible by the opening of the N.-W. Railway which provided accelerated means of transport. The fishermen then directed their attention to beds in the Kharanji and other Sind creeks. At present the condition of these oyster beds is far from good, because they have been depleted through overfishing

Statement showing the number of oysters imported into Karachi from December 8, 1896 to June 29, 1908.

Year.	Indus Creeks. Dozens.	Karachi Nawar Nar. Dozens.	Hab-river. Dozens.	Cutch. Dozens.
1896–97	9,000	...	...	3,000
1897–98	17,150	...	...	...
1898-99	16,900	900	1,700	...
1899-1900	15,700	...	600	17,000
1900-1901	8,503	...	500	19,500
1901-1902	9,300	340	...	17,300
1902-1903	1,750	190	...	21,000
1903–1904	...	70	500	17,500
1904-1905	...	100	3,400	6,500
1905–1906	13,030	...	...	7,900
1906-1907	4,930	...	...	8,900
1907-1908	...	875	1,100	4,800



1. *Ostrea discoidea* (Gould). The right valve removed.



2. *Ostrea discoidea* (Gould).

Statement showing the number of oysters fished in Karachi and from the Sind Creeks.

Year	Dozens	Royalty Rs.	A.	P.
1921-22	7,635–1	636	7	6
1923-24	15,288–6	1,051	13	6
1924-25	5,441–4	495	13	11
1925-26	3,519–2	502	1	8
1926-27	4,998½	860	2	0
(Closed)				
1927-28	983	172	6	0
1928-29	5,049$\frac{10}{12}$	1,086	8	6
1929-30	3,857	799	9	6

Oyster Season. 1929–30. Nov. 22, 1929 to February 19, 1930.

	Bram Hydri Rocks.	Dubba.	Piatiani.	Maurypur	Phity.	Kajar.	Hab River.	Kharanji.	Khudi.
Dozens ...	163	780	1,329	284½	536	334½	250	55	125

Grand Total=3,857 Dozens. Royalty recovered=Rs. 799-9-6.

It is interesting to note that 21,000 dozen oysters were imported into Karachi from Cutch creeks in the year 1902–03 but the trade diminished later because the State authorities began to charge very high taxes for the oyster exports form the Cutch State creeks to British India, i.e. Karachi. At present there is practically no trade with Cutch. During the last 30 years the oyster beds in Karachi and Sind Creeks have been practically wiped out. The demand for oysters has increased and the orders at Rs. 1–8, Rs. 2 per dozen are even refused for want of supply, but nothing has been done so far to increase the supply for the markets.

Attempts have been made by the customs authorities at Bram Hydri (Kharanji Creek) to breed oysters. But, so far, they have not been successful for the following reasons:—

1. Small extent of the natural oyster beds, to supply the Government groynes with spat.
2. Absence of any cultch in the creek.
3. Presence of soft mud which does not allow the cultch to remain clean and smothers the young spat when it settles down.

Bombay. To the south of Bombay the chief oyster-producing centres are Ratnagiri, Jaytapur and Karwar. There are large natural oyster beds all along the coast in the creeks and backwaters.

In Bombay and its neighbourhood, oysters are collected in large numbers by the local fishermen from various natural oyster beds, situated along the coast and transplanted to Mahim and Satpati (Palghar) where they are cultivated on a large scale. The oysters are also sent out to mofussil towns after satisfying Bombay demands.

There is a great demand for oysters in Bombay, and the oysters are sent to the city from many of these coastal towns, but the trade suffers because there is no regular and definite supply. Many thousands of good oysters may be made available if some proper distributing agency was formed in Bombay. The oysters from the local creeks are large and good-flavoured. In the fair season the oyster supply could be arranged regularly since the steamers ply between Bombay and Goa, touching daily at some of the oyster-producing coastal towns to the south of Bombay.

Thousands of shelled oysters are despatched to clubs, hotels and private individuals in Bombay and outside. The local demand varies from 1,000 to 2,000 dozens of oysters per month. Many more thousand dozens would be sold if scientific methods were followed. At present there is a suspicion among the public that enteric fevers are caused by oysters. During the whole season 3,000 to 6,000 dozens are fished in Bombay and Salsette Islands. The price varies from annas 8 to 12 per dozen. The total earning from all the oyster farms in Bombay and Salsette Islands is approximately Rs. 2,000 to 3,000 per annum. As to the number of people employed in the industry it is not easy to give exact figures, since no licences are issued to men engaged in the oyster industry. Approximately there may be 5,000 to 7,000 people who are engaged in the oyster industry all along the Bombay coast.

Fishing Season. The oysters are fished from November to March when they become plump and white and are in a good marketable condition.

Fishing from the farms ceases between March and October as oysters are not in demand in the off-season. Moreover they are not fit for the market during the spawning season (March to May), while they are in a poor condition, and their soft parts are watery during the monsoon (June to October).

Methods of collection. The oyster farms are exposed at full low tide. Oysters which are found below the low-tide mark are collected by diving. The shells are removed from the beds by means of an instrument locally called *Koodal.*

After collecting, the shells are opened by breaking them and the soft parts are scooped out by means of an 'Oyster Knife.' They are stored in an earthen pot containing sea water and their soft parts are sold in the market. Sometimes, to save freight and ensure proper icing, the soft parts of the oysters are packed in tins before they are despatched.

By-products. The empty shells of oysters are used for making lime. They are crushed and put in a kiln, where they are burnt. The burnt fragments are then powdered. This product is much valued because it makes an excellent lime for building purposes. The empty shells are rather cheap and are sold at the rate of four to six annas a maund. Large quantities of oyster and clam shells are exported from the southern creeks to the different towns along the Bombay coast after satisfying the local demands. The following statement will give some idea of the export of oyster shells to Goa.

Statement showing the yearly exports of Oyster shell to Goa from the port of Tadri for the years from 1915–16 to 1920–21.

Year	Quantity of Oyster shells exported			REMARKS
	Tons	Cwt.	Qr.	
1915–16	1,043	10	...	*Note.*—No imports of Chunnam from Goa during the said period.
1916–17	718	10	...	
1917–18	687	...	...	
1918–19	1,434	7	...	
1919–20	1,037	10	...	
1920–21	135	...	...	

PRESENT METHOD OF OYSTER CULTURE

1. *Oyster farms.* None of the western methods of farming oysters are employed in this part of the country. It is not known definitely when the oysters began to be farmed in the different creeks (Mahim, Satpati, Palgarh, etc). There are many such farms round about the Islands of Bombay and Salsette, but the Mahim and Satpati farms seem to be the most prosperous. The oysters found there are large, well-shaped, and in excellent condition. The area of the various farms is small. All of them are well above the line of the low tide. The ground selected for farming is hard. It is composed of clay and sand covered over with a thin layer of mud.

The method employed at present at Mahim and other farms is as follows:—

Young oysters, more or less an inch in diameter, are collected from the open sea and other exposed places. They are then planted in certain selected spots which are easily accessible in all tide conditions. These transplanted oysters are generally cleaned once or twice a month at the low tide and replanted in order to prevent mortality from various enemies. Under these conditions they grow rapidly, and within three or four years they measure about four to six inches in diameter.

2. *Cultch.* No attempt has yet been made by fishermen on our coast to employ a suitable cultch for rearing oysters. The spats are found on the natural cultch in the form of shells of oysters, dead or living, or stray pieces of stones, bricks, tiles, etc. The putting out of the cultch marks the highest stage yet attained in oyster culture, and different methods of distributing cultch are employed in different countries. At Arachan (France), tiles covered with a thin layer of lime mixed with sand are used as cultch, while in Japan, bamboo sticks are employed for the same purpose. In India we can

as easily make use of mangrove branches and the shells of oysters and other bivalves as cultch as they are cheap and easily obtainable wherever oyster beds are found.

CAUSES FOR THE DEPLETION OF THE OYSTER BEDS

(1) Immense harm has been done to the oyster beds by over-fishing. In some cases, oyster beds which were known to produce excellent oysters, have been destroyed completely. More oysters are fished every year from the natural oyster beds than the oysters produced from the farms. That is, the number of oysters fished in a certain locality are more than the young ones annually produced in that locality.

(2) Sometimes the oyster clumps are taken from these natural beds, to some convenient place near the high-tide mark and the well-grown specimens are separated over there; but the young oysters removed from the beds, are never replaced on the natural beds or transported to the farms, and die of exposure on the shore. There is a great waste all along the coast because of this practice among the ignorant fishermen.

(3) No close seasons are kept, that is the oysters are fished by the poor fishermen all the year round.

THE OYSTER INDUSTRY IN FOREIGN COUNTRIES

During recent years the study of oysters and the oyster industry have made a great advance in the western countries.

Europe and North America are the great homes of the oyster industry. There are great oyster farms in France, Great Britain and U.S.A.

The value of the world's oyster crop of marketable oysters in 1923 was estimated approximately as $20,000,000.

The production of England and Wales (in 1916) was 31 million oysters (value £207,909). The total production of market oysters in U.S.A. according to the statistics of U.S. Bureau of Fisheries was 17,176,163 bushels with a value of $12,618,135. France produced oysters worth 27,000,000 francs in 1912.

The world's Oyster production according to statistics from the 'British Encyclopædia' (1930) is as follows:—

Country	Year	Quantity	Value
U. S. A.	1925	20,000,000 bushels ...	$ 14,000,000
Canada	1926	2,255 ,, ...	$ 152,073
England and Wales	1926	15,857,900 ,, ...	£ 150,757
Fal Estuary	1926	2,500,000 ,, ...	£ 8,750
Japan	1924	2,032,744 kwam ...	Yen 616,713
		(Kwam = 8·27 pounds)	

SUGGESTIONS FOR IMPROVEMENT OF THE OYSTER INDUSTRY ON THE BOMBAY COAST.

In our country the oyster industry has been completely neglected and there is a great field for its development, as little has been done so far to take the full advantage of the rich harvest of the sea.

The natural oyster beds which extend over large tracts along the coast with an approximate area of 2,000 acres could be easily made to yield a much higher revenue than under present conditions. Those engaged in the industry do not know the value of farming oysters on scientific principles. The selection of the ground, the specific gravity and the temperature of the sea water, the oyster food in the locality, the necessary conditions for reproduction, their life history habitat, tides, currents of water, the grounds and the time and method of distributing the cultch, are all subjects which require investigation. Expenditure on such investigation would be amply repaid by the greatly increased supply. The oyster is very prolific for it produces millions of eggs in one season, but comparatively small numbers reach maturity. On our coast all oyster beds are above the lowest tide lines, and the oyster-farming can be developed on our shores in a few localities. In the beginning there may be failures, disappointments, but in the long run scientific cultural methods must succeed. The annual production of marketable oysters along the Bombay coast may be approximately 200,000 dozens with a value of Rs. 50,000.

It is time that our energies were directed to the greater production of the best and the cheapest food on our coast. It is possible, while working on such scientific lines as may suit local conditions, to convert the barren and unproductive shallow waters into rich and productive lands.

Difficulties in applying foreign methods of culture:—Foreign methods of oyster culture on our shore are not possible for the present, for the following reasons.

1. Poor fishermen.—They cannot afford to employ the expensive and complicated methods employed in western countries.

2. The fishermen are not educated, and are conservative by nature. They will not readily practise these methods even if they are demonstrated.

3. Moreover, no large profits are now expected from the oyster trade, while they get good returns in other fisheries (our waters are very rich in edible fishes).

As a matter of fact, we can also produce fine, large oysters. There are many factors which make oyster culture easier in our country than any other country. The following few points may be mentioned :—

(1) Rapid rate of growth of our oyster.

(2) Waters are less muddy.

(3) There are many very good creeks which are known for the excellence of their oysters.

(4) Cheap spat collectors (shells, etc.).
(5) Few natural enemies.

A few notes on oyster culture of a simple and practical nature may, at this place appear opportune. They are included here with a view to helping agencies or individuals who have undertaken or propose to undertake oyster culture.

Before commencing oyster culture, it is necessary to prove that the waters are suitable for the proper setting of the brood, and that the conditions are fairly good for its development, growth, etc.

Oyster-farming :—The following conditions are necessary for successful breeding of oysters :—

(1) The ground must be sufficiently hard and clean for the spat. Millions of eggs that are emitted by the oyster never come to life at all, because the majority of them perish at the larval stage when they try to settle down, and only those survive which settle and lie on hard and clean surfaces.

(2) There should be no excessive variations in the salinity of the water (such as may be caused by floods or rains). The beds should not be exposed to extremes of temperature.

(3) Sufficient food for the oysters should be available (i.e., diatoms, spores and other microscopic animals and plants).

(4) Some suitable spat collectors should be employed (tiles covered with lime and sand, mangrove branches or shells, etc.) and nurseries constructed for young oysters.

(5) The beds should be protected from organic and inorganic enemies (star fishes, drilling molluscs, crabs, sand, mud, etc.).

(6) The tide conditions should be favourable (that is, the oyster beds should be exposed for some time under very low tide for cleaning and arranging the oysters on the beds).

(7) The young oysters and 'Seed oysters' should be saved from mud and other sediment by keeping them in boxes or rakes a few inches above the bottom of the bed. Simple and cheap boxes with trays can be used with wire-netting at the bottom and at the top, and these, if proper care is taken, will last for 10–15 years. After one or two years when the oysters are a good size, they should be removed to the oyster parks.

Improvement of Natural beds.—Oyster-farming can never be very extensive on the Bombay Coast, as large suitable grounds for oyster farms are not available. The natural oyster beds can however be easily made to yield more revenue than under the present conditions.

In order to encourage the industry in the Bombay Presidency, oyster-fishing in certain creeks and backwaters, which are now known to yield an excellent quantity of oysters should be controlled, to prevent overfishing. The Bombay Government should extend to other parts 'its Section 37 of Land Revenue Code (Bombay Act V of 1879) which exercises the rights of proprietorship over the oyster beds in the Sind Creeks.'

The following steps might be taken to put the Bombay oyster industry on a proper footing. It is interesting to note in this connection that some of the recommendations here made, *i.e.* (2), (3), (4), (7), were introduced by Mr. Walke in 1920, to replace and regulate the oyster beds at Tadri (Kanara district), which were said to have been destroyed by the fishermen. A few precautionary measures were adopted by the Superintendent of Fisheries to improve the oyster beds, and a prohibition order was enforced for the protection of these beds, but they were later cancelled, because the orders were not actually observed. The copies of the correspondence bearing on the subject of oyster beds in Tadri creek, and the operation and the effects of the orders prohibiting the removal of the oysters from the beds, with a detailed report from the Sirkarkun, Sanikatta are given in Appendix III.—

Recommendations—

(1) Licensing of fishermen employed in oyster-fishing.

(2) Observing a close season every year (March to May) when the oysters spawn.

(3) By enforcing a long close season for some years in certain areas where natural beds have been badly depleted.

(4) Forbidding the fishing of oysters under three inches.

(5) Accurate information to the public regarding the edible oyster, its food value and the distributing agencies, etc.

(6) A thorough survey of the oyster beds in different parts of the Presidency.

(7) Introduction of artificial cultural methods where possible (only the practical, simpler methods may be tried).

(8) Reclamation of depleted beds by artificial means :—

i.e. By restocking the old beds, i.e. by transplanting oysters.

(9) Oyster parks as reserves at some suitable localities.

(10) The fishing should be so arranged that the average number of adult oysters should not fall below the oysters fished or the oysters produced annually on the oyster beds. 'This it is not a matter of extending the close period, it is the control of the beds when open to fishing which is the essential to successful regulation.' (Hornell).

(11) The establishment of one or two experimental oyster farms along the coast where different methods of culture may be tested under the supervision of a Superintendent with practical scientific knowledge of the subject.

(12) Preservation of certain creeks for experimental purposes, as for example Jaytapur, Tardi, Satpati, Kalve and Navapur creeks, which are known to produce excellent oysters affords a good field for oyster culture for the following reasons :—

i. Extensive natural oyster beds are present in the creek, large area is available and can be increased if necessary.

ii. The bottom is hard and well suited for oyster culture. A large clean surface is available for the spat.

iii. Oyster cultch is available in large quantities (Shell-fishes i.e. Tapes, Meretrix, etc.) so that the bottom of the basin may be reclaimed and made hard and firm by a covering of shells.

iv. Seed is abundant.

v. Abundance of food material in the creek (diatoms, algal spores, etc.).

vi. Very few oyster enemies in the creek (star fishes, drilling mollusca, etc.).

vii. The oysters found in the creek are large and the growth is vigorous and they attain the marketable size in 2–3 years.

viii. The oyster beds are protected from the direct effects of open sea.

ix. The majority of the natural oyster beds are covered at half tide, and a large area in the creek is exposed during the spring tides, so that the cultural operations can be carried on during the ebb tide.

x. Sewage conditions are much better than in any other creek along the coast.

MINOR SHELL-FISH INDUSTRIES.

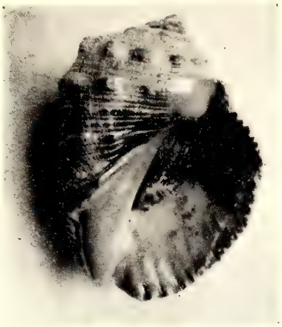
In addition to the above-mentioned true shell-fishes which are fished and consumed in large quantities, there are several other species occurring along the Bombay coast, which are not found in very large numbers to form a shell-fish industry, but the following forms are of local interest and are fished for local markets.

(1) Mytilus (Sea-Mussel)
(2) Cardium (Cockles).
(3) Arca ,,
(4) Venus ,,
(5) Dosina ,,
(6) Mactra ,,
(7) Circe ,,
(8) Donax ,,
(9) Pecten (Comb-shell).
(10) Solen (Razor-shell).
(11) Placuna (Window-pane Oyster).
(12) Purpura (Whelks).
(13) Natica ,,
(14) Umbonium ,,
(15) Cypræa (Cowries).

BIVALVES.

1. *Mytilus* (Sea-Mussel).—This mussel, which is found along our coast, has a beautiful green colour. It is comparatively rare but its flesh is highly esteemed and considered as a delicacy by the fishermen. It grows from 5–6 inches in length and is found at Karachi, Bombay, Ratnagiri and Karwar. These molluscs form an excellent food but, as they are scarce and cannot be easily collected, they are seldom brought for sale in the market. They are a brackish-water form and generally found where the tidal streams are strong and water deep. They attach themselves to rocks and stones with a gelatinous secretion known as the byssus which is secreted by the byssogenous gland situated in the foot. Being gregarious in habit, they crowd in certain localities where they can be gathered in large numbers. They are also found in oyster clumps. In the deep waters *Mytilus* is collected by diving, and separated from the rocks by means of an iron chisel. It is only fished during the fair season, and at a very low tide.

2. *Arca*. (Cockles).—One never meets this form very often and even then it occurs scattered on the shingle sandy flats. It occurs at Bombay, Alibag, Ratnagiri and Jaytapur. In size it seldom exceeds 5–6 cm. It attains marketable size in about two years. The flesh is coloured due to the coloured blood in this lamelli-branch.



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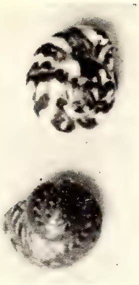

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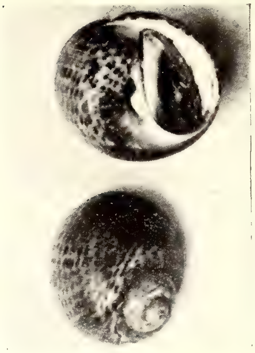

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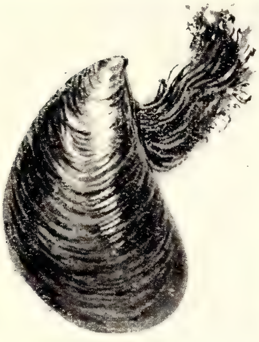

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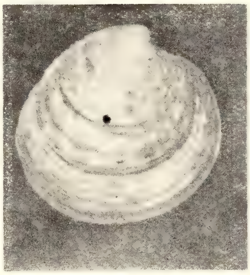

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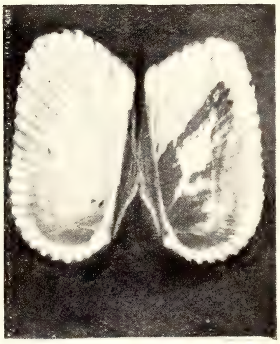

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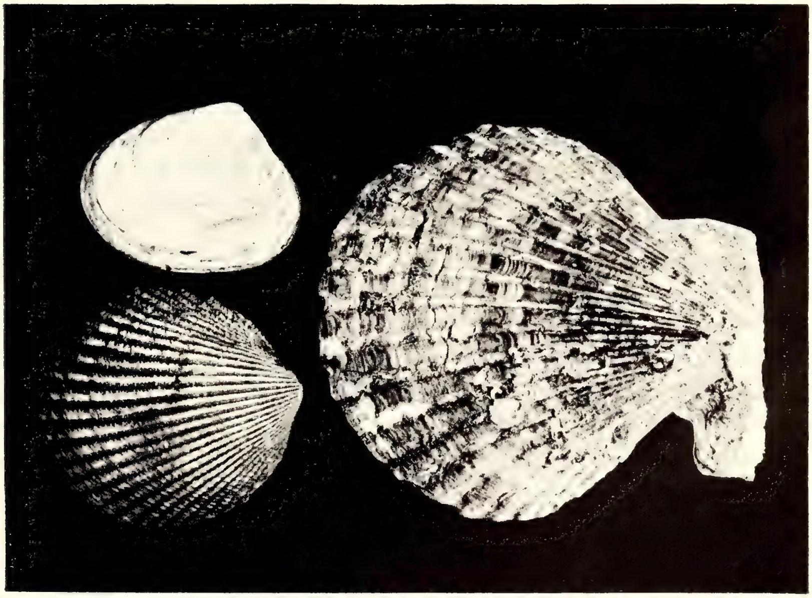


7.

1. *Purpura carnifera.* 2. *Umbonium vestiarium.* 3. *Natica ala papilionis.* 4. *Mytilus smaragadinus.* 5. *Dosina prostratus.* 6. *Arca inaequivalvis* (Burg.). 7. *Pecten townsendi* (Sow) [right], *Cardium rugosum* (bottom left), *Tellina edentula* (top left).

3. *Cardium* is found in Karachi harbour on the muddy flats and is collected by the fishermen for their own use. It grows from 3–4 inches in length.

4. *Pecten* (Comb-shell) is rarely found alive on our shore. It is highly esteemed and considered as a delicacy by Europeans and is caught in large numbers in Europe and U. S. A. It is more a deep-water form. Its shells are found washed ashore, but no regular beds have been located along the Bombay coast. The shells collected from some localities measure 6–7 inches.

5. *Venus* is a common cockle in Bombay and along the southern creeks (Alibag, Ratnagiri and Jaytapur). It is found in fine sand, even when mixed with mud. It is almost circular in form and has a strong glossy white shell with fine concentric lines of growth. Fully-grown specimens measure about 3–4 cm.

Solen sp. (Razor-shell) lives in sandy tidal flats and is found from 6 inches to 2 feet deep in the sand. Its habitat is near the lowest tide mark, and it even extends into water which may be several fathoms deep. It buries itself very quickly with the help of its large and powerful muscular foot which is present at the anterior end of the body. A full-grown specimen is 3–4 inches in length. The semi-transparent shell is white, or yellowish white, in colour. The valves of the shell are long and narrow and gape at both ends. The empty shells are found on many sandy beaches washed ashore, but the living animal may be collected from Juhu (Bombay) and Jaytapur. In Jaytapur they are dug out in fairly large numbers for food purposes.

Placuna placenta (Window-pane Oyster) is found in hard mud in the creeks and backwaters. It is a brackish-water form. When young the valves of the shell are thin and almost transparent and the soft parts of the animal can be seen through it. As the animal grows old the valves become thicker and translucent. The shells are used as substitute for glass panes; hence the name Window-pane Oyster. The shells are also used for decorative purposes in gardens.

The pearls produced by this species are of inferior quality and low in value, because they are small in size, poor in lustre and wanting in hardness. Pearl-fishing along the Bombay coast is a minor industry. These Pearl oysters are found in three localities in the Karachi Harbour, on the Jamnagar Coast and in the Thana creek (Bombay). None of these beds are extensive. The true Pearl oyster (*Margatifera sp.*) is not found along the Bombay coast.

The Sind beds (Karachi Harbour) have been practically destroyed due to overfishing. There is practically no pearl fishery along the Sind coast now. The beds are under the control of the Customs Department in Sind and they collect the royalty on the pearls fished along the Sind coast.

'The fishery in Sind is of comparatively recent origin. It was discovered by the Mirs about 1836. Since the British Government took possession of Sind, the fishing of the banks has been leased by Government periodically for very variable amounts, ranging from the comparatively high figure of Rs. 6,205 in 1849 to as low as Rs. 617 per annum for a period of three years in 1904, a gradual diminution of revenue due without doubt to overfishing and the financial impossibility of maintaining a supervising establishment adequate to enforce a proper regard for cultural safeguards' (Hornell, 1909).

On the Jamnagar coast the Window-pane oysters are of good quality and are fished in large numbers. The fishing is carried on under the supervision and control of the Jamnagar Durbar.

A small bed of these oysters is found in Thana Creek at *Musi* (?) but the fishery does not bring much revenue to the State.

Pearl oysters are found scattered in many other localities along the coast. But no regular beds are found in any other place along the Bombay coast. In Jaytapur they are collected by the poor shore-dwellers and are eaten along with the other shell-fish. But the flesh is not much liked because it is not so tasty.

GASTROPODS.

All the Gastropods found along the Bombay coast are of restricted use and purely of local importance. None seem to be used as food on a large scale and none of them are eaten on the Sind coast.

The following edible Gastropods are collected along the Bombay coast for food.

1. *Purpura* (Rock Whelk). It is found to a small extent along the Bombay and Konkan Coast, near the rocks and collected along with other shell-fish and cooked along with the rest. Its meat is extracted after being boiled for some time. It measures about 50–60 mm. in length.

2. *Umbonium.* Common at Malwan. During the months of March, April and May large quantities of them are sent to the markets. A beautiful Gastropod with many bright colour bands on the shells. Its size is very small, measuring about 10–12 mm. They are boiled in fresh water and the meat is extracted with a needle. The flesh which is very tasty is used either in curry or in soup.

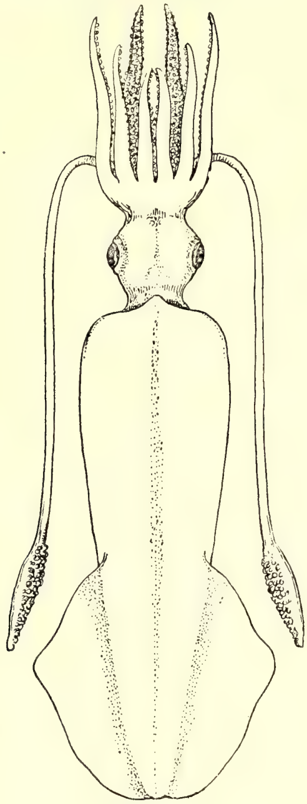
3. *Natica* is another Gastropod which is collected in some southern creeks for food. It is found in the sandy beds along with the *Tapes* and *Meretrix* at Ratnagiri and Jaytapur creeks. It measures about 20–25 mm. The shell has short spirals with beautiful bright coloured spots. Its flesh is much liked by the fishermen and generally used in curry.

CEPHALOPODA. (Cuttlefish & Squids).

Only two cephalopods (*Loligo* and *Sepia*) are caught for food from November to May. They are sold in the market and have considerable economic importance on the West Coast. Considerable quantities of these molluscs are sun-dried but they are mostly sold fresh in the markets. They are highly esteemed by the Chinese and the Japanese and are considered a marine delicacy. The two most valuable and abundant forms are Loligo (squid) and the Sepia (cuttle fish). They are caught along with the other edible fish by the fishermen all along the coast.

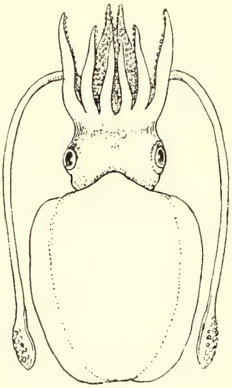
1. The Common Squid (*Loligo sp.*). Squids are caught in large numbers along Sind coast and are sent to the Karachi market. They are also found in large numbers round about Bombay and are sent to the Bombay market. In Bombay the rates vary from annas

1–2 a dozen. When there is less demand they are sun-dried and sold eventually at about 2 annas a dozen.



Loligo sp.

2. Cuttle fish (*Sepia sp.*) The cuttle fish is valuable for its shell which is used in medicine as well as for polishing wood. Cuttle fish shells are often found washed ashore but not in such abundance as to form a local industry. In the adult condition they are usually 6–8 inches in length; they are liked much as food by the fishermen and are also used as bait. They are sold in the local markets, but the supply is not very regular. The market rate varies from 1--2 annas a dozen.



Sepia sp.

(*To be continued*)

THE STUDY OF INDIAN BIRDS.

BY

HUGH WHISTLER, F.Z.S., M.B.O.U.

PART X

(*With 1 text-figure.*)
(*Continued from page 644 of Vol. XXXV.*)

MIGRATION.

In starting the last article of this series I am only too conscious of the fact that it will be the most difficult of all to write. It is not only that one may study migration for years and yet learn very little definite about it. But in India, particularly, so little is known about the subject that it is impossible to write for Indian readers merely on the Indian aspects of the question. I can only write as an observer of an enquiring turn of mind who wants to know something of the subject; and who therefore sets down his ideas and impressions on paper in the hope of clarifying them and in the hope that the recital may help others to some appreciation of the fascination and difficulties of the subject. India should be one of the most interesting countries in the world to the student of migration. Yet this aspect of its bird life has been so neglected that there is as yet no material from which I can write on migration purely as it concerns India. I shall therefore try to summarise in general form the main aspects and principles of the subject—in their universal application—hoping perhaps that the recital may be of help to those who are in a position to study their local application. If my paper will turn any of our Indian naturalists to the study of migration, it will fulfil its purpose.

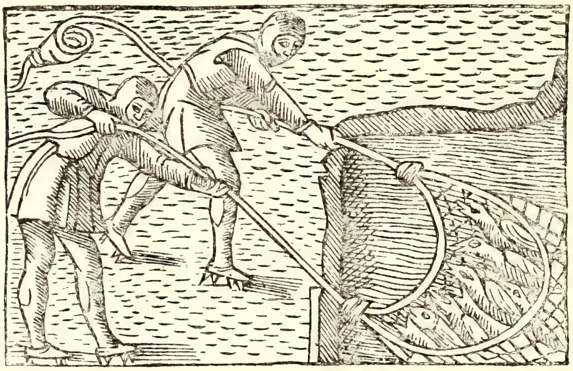
There are few aspects of Ornithology on which more has been written than migration. Up to a certain point we know a great deal on the subject. We know which birds migrate, at what seasons they come and go, what routes they follow and also a certain amount about their behaviour while migrating. Yet our exact knowledge stops at that point where the fundamental and most obvious questions arise. Ask yourself what the primary questions should be. I should answer and probably most of you would answer too—I want to know why birds migrate and how they find their way. Yet it is exactly these two questions which at present cannot be answered, though a great deal has been written in the endeavour to provide an answer. Answer these two questions and all our present exact knowledge would fit in round the answers as a mere elaboration of detail.

The starting point of most enquiries is usually definition. What is this migration which we seek to understand? My dictionary defines migration as follows:—'a change of abode: a removal from one country or climate to another; a number removing together' and it goes on to define migratory animals as 'animals that remove from one region to another as the seasons change'. Now these definitions do not quite serve our purpose, as a little reflection immediately shows. The Historians tell us of the migrations of the human race and more particularly of the mass movements of the Aryan stocks from an origin in central Asia. The Economist and the Politician tell us of the migration of Industry from north to south in England of to-day. The naturalist tells us of the migrations of the Lemmings in Northern Europe which end in wholesale destruction in the sea. The migrations of the Sandgrouse into the British Isles are a theme of the country chronicler. Yet all these movements are different from what the ornithologist has in mind when he speaks of migration. For he is thinking of a mass-movement which differs from those other mass-movements, even of the Sandgrouse, in one essential characteristic. Those movements may be huge and marked, yet they are irregular. No one can foresee them or count on them. There is usually a finality about them. They are an inundation which overflows a country. Its mark may be enduring or ephemeral but there is no rhythm of recoil. Bird migration on the other hand is one of the great rhythms of the world, a seasonal ebb and flow which moves as surely as the ebb and flow of the tides, the change of the seasons, the passage of day and night. We can confidently foretell that a thousand years hence the swallows will be migrating with the seasons as they were when the Prophet Jeremiah wrote 'The Stork in the Heaven knoweth her appointed times and the Turtle and the Crane and the Swallow observe the time of their coming'. Our definition must be therefore more particular and run something like this:—the seasonal and rhythmic mass-movement of a large contingent of a species from its breeding ground to its winter quarters and back again. Migration in this sense is largely confined to birds. A few species in the other natural orders practise it, but in no other order is it so general and marked.

It is not strange that from a very early date man noticed the phenomenon. I am not well enough read in the Indian classics to know whether it was remarked on by the early Indian writers, but most of us know the earliest reference in the Bible. In the Book of Job we read 'Doth the Hawk fly by thy wisdom and stretch her wings towards the south'. Homer and Hesiod mention the passage of the cranes, and Anacreon welcomes the return of the swallow to Greece. About 350 B.C. Aristotle actually discussed the question in a scientific spirit and it is evident that in these early days men appreciated the existence of the phenomenon and its problems.

What is more strange is to realise that in Mediæval Europe this accurate, if not extensive, knowledge was lost and was replaced by the most absurd theories. Even mediæval man could not fail to remark the presence or absence at certain seasons of common and conspicuous birds. Yet his explanations were extraordinarily crude. One theory was that the missing species retired to the moon; another suggested that birds changed their form. That the Turtle-Dove of summer became the Stock-Dove of winter, the Redstart became a

Brambling was I suppose the application of the theory if it was not even more fantastic in detail. But perhaps the most universally believed suggestion was that the missing birds hibernated in hollow trees and ponds. The accompanying figure shows a picture in a book by Olaus Magnus (Archbishop of Upsala about 1550) of



fishermen standing on the ice and drawing in a mixed catch of swallows and fish. This belief lingered on to a surprisingly late date. Even when men were prepared to believe that large birds did actually migrate—and anyone who had witnessed the passage of cranes could hardly refuse belief—they thought that small birds must travel on the backs of the large ones as passengers.

However, we must leave the realm of ignorance and come to the question of our present-day knowledge.

If any of my readers is now starting to study birds I would suggest that his first need is to shed a popular delusion. People who are not naturalists start with the idea that a bird is by reason of its possession of wings a very irresponsible and free creature. I think they commonly picture it as here to-day, gone to-morrow, moving on incessantly with no ties, except in the breeding season, sleeping wherever the fortune of the day's wanderings have taken it. This is very far from the truth.

The avifauna of India, or any square mile of it, is never stationary. Season by season and almost day by day it changes in response to the stimulus of migration, climate and food supply, but this change conceals an order and a staticness which is surprising. A bird is really very regular and tied in its habits and movements though the possession of wings and great mobility obscure the fact. A little observation soon shows that this is so. If you take the trouble to watch the birds within the immediate range of a short daily walk of your bungalow you will notice that a particular shrike is always haunting the same little clump of bushes. He has several favourite perches, on one of which you generally see him. If you disturb him he generally does much the same thing. If you chase him deliberately away he retreats only within a certain radius of his favourite spot. If you take the trouble to make sure that he leaves his little territory altogether, you will find him back there next time you return.

If your observation becomes more intense, you will find that he sleeps always in the same place and probably follows a very regular routine in his habits and movements in his little territory. The same with other birds. You realise that a particular bough is the favourite perch of a Black Redstart or a Red-breasted Flycatcher. With increasing interest and observation you learn that the mixed hunting party of warblers, creepers and tits which always seem to be on the travel are really only pursuing a constant round which day after day you will find them traversing. The Lugger Falcons on the church tower, the vultures that brood obscenely on a clump of peepul trees are really just as tied as the shrike and the flycatcher to their homes and habits. The falcon is larger and swifter, so his hunting ground is wider than the shrikes. The vulture may range ordinarily over a hundred square miles for his occasional gorge. The only difference between them all is that their territories and range vary according to their circumstances, and some have their habits more readily interfered with by the exigencies of their food supply. Circumstances permitting, the bird is as much a creature of home as we ourselves.

Once we have grasped the conception of a bird as a creature of a fixed home and habits, we are in a much better position to think of it as a migrant. But there are many stages in between the two states.

Biologists inform us that a new generation is always in wild nature, so far as circumstances allow, started in the ancestral home of the race. By this they mean that when the eel migrates from its inland river to the depths of the Atlantic to spawn, we must regard the ancestral call of the ocean origin of the eel as being stronger than its more modern adaptations to a fresh-water life. It is with this biological rule in the back of our minds and also for practical convenience that we usually consider a bird's breeding territory as its home. In considering migration we therefore start on the common ground (with all species and types of movement) of the breeding territory as the starting point. This must be borne in mind in the discussion that follows.

Now it is an axiom of all migrational studies that the breeding ground of a migratory species is, as a general rule, in the colder and therefore more northerly part of its complete distribution. Although not of universal application, this rule is so general that all theses on migration have necessarily to allow for that point in their explanations and we shall have to return to it later. In the meantime, we must consider the effect that migration has on the bird life and bird distribution of any given area.

The most extreme case of migration which could concern us in India and Ceylon would be that of species which nested within the Arctic Circle in Northern Siberia and wintered in the Island of Ceylon. This particular species would therefore obviously stand in very different relationships to the countries in the whole of its range from N. Siberia to Ceylon. In N. Siberia it will be a summer visitor only ; but as this is its breeding ground or home a comparatively short residence of perhaps only three months of the whole year will be sufficient to mark it for all Zoo-geographers as a Palæarctic species and as such it will be considered by them in all estimations of the faunas of the other countries that it visits. In a comparison between the Fauna of Ceylon and the Malay countries, for instance, it will be ruled out of the discussion as of little or no importance. In Ceylon the bird will be a winter visitor only.[1] In the countries between N. Siberia and Ceylon our bird will be a passage migrant, travelling through southwards in autumn and returning northwards in spring. Should it travel southwards by a westerly route and northwards by an easterly route or vice versa, it will be a spring passage migrant in one set of countries and an autumn passage migrant in another set. The condition however remains that wherever it is on autumn passage its direction will be ultimately north to south, and wherever it is on spring passage its direction will be ultimately south to north, however local conditions may temporarily obscure the point.

This is migration in its most extreme and obvious form for, as is usually stated, species which breed far to the north usually winter far to the south. But as we leave the extremes the position becomes more complicated. In the extreme north the summer visitor has little option but to migrate. It is for him the only method, in most cases, of answering the problem of winter. For one must never lose sight of the fact that all life in northern latitudes has as one of its major problems the question of conserving the species through the rigours of winter. This problem presses more hardly, the smaller and shorter-lived the species.

The short Siberian summer provides ideal conditions for most birds to breed and rear the new generation. Food is abundant, temperature is satisfactory, space and freedom for wild life are illimitable. With winter there is a most decisive change. In a dead world of snow and ice the myriad birds of the summer must die—or leave; and having wings they leave.

Further south, however, with more temperate conditions, the issue is not so clear-cut. There we find that migration takes on a fresh attribute and we are confronted with the phase known as partial migration, that is to say some members of a species leave and the remainder do not. Some individuals are resident, to express it differently and others are only summer visitors. This in turn may become still more complicated further south in the range of a species where, in addition to some individuals of a species being resident and others summer visitors, there may be others which are there as passage migrants or even winter visitors from further north in the range.

It may be as well to take a concrete example of this complicated state of affairs, and this is well afforded by that well-known species the Pied Bush-Chat (*Saxicola caprata*) in N.-W. India. Now in one district of the Punjab it is easily possible for this bird to be a summer visitor (as the majority undoubtedly are), a resident (as a small number of individuals are), a winter visitor and a passage migrant

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[1] We may remark here in parenthesis that Ceylon being for all practical purposes the most southerly land in this section of the world, has no summer visitors. In other words all land birds breeding in Ceylon have to be residents as there is no land southwards for them to migrate to, fulfilling the condition of breeding in the north and wintering in the south of their distribution.

(as a certain number breed in Turkestan as summer visitors and pass southwards across the Himalayas in winter). A casual and inaccurate observer, especially if tied to that particular district and ignorant of the work of other observers, might there easily fall into the mistake of thinking the species a resident where in fact it fell into every class of migrant.

I will emphasise therefore, by recapitulation, that the first point in the study of migration is to realise that it must be considered always in terms of the following divisions, to all of which a particular species may belong in some phase of its movements as a migrant, viz.

(*a*) Summer visitor.
(*b*) Winter visitor.
(*c*) Passage migrant with subdivisions (i) spring, (ii) autumn.
(*d*) Partial migrant.
(*e*) Vagrant.

This last division refers only to individuals which become lost on their migrations and turn out of their proper routes. It should not be used as a synonym merely for rarity on a normal passage route.

Side by side with migration, in whatever aspect of those subdivisions it may appear, we meet with another series of mass-movements which may be easily mistaken for migration. These movements are of several types of which the following may be suggested as examples, viz.—

(*a*) Overflowing of a population which has for some reason become overcrowded.

(*b*) Pursuit of a special and temporary food supply.
(*c*) Response to certain weather conditions.
(*d*) Local movements.

There is no need to elaborate examples of these movements, but it is well known that the passage of a flight of locusts is followed by a vast concourse of birds that feed on locusts; that early campaigns were accompanied by the shifting of the vulture population; and that an excess or failure of the monsoons has a great effect on bird distribution in India.

Movements of these types do not fulfil our primary definition of migration in the specialised sense. Such movements are irregular. There is no rhythm about them. They have not necessarily any connection with breeding. But I think they must be borne in mind by all who study migration as I think they help to throw light on the genesis of migration though this is not admitted by all writers.

The border line between true migration and these irregular mass-movements is at any rate very ill-defined. Local movement, for instance, is found in every shape and degree and at one end of the scale it certainly merges into the definition of true migration, albeit on a very small scale.

The simplest form of local movement can be illustrated in the case of the House Sparrow (*Passer domesticus*). In the breeding season this bird acts up to its name and chiefly frequents the houses in every village, breeding in pairs in every suitable place. As soon as the young are on the wing, which for the most part coincides with the ripening of the autumn crops, sparrows leave the villages in great numbers and gather in flocks in the fields. Their movements are then quite erratic and depend on a food supply of ripening grain. This may entail extensive movement, in different directions in different years. Local movement of this type also occurs commonly on a very small scale, as when the Wren-Warbler (*Prinia inornata*) moves literally from field to field in response to the crops which give it cover for its unobtrusive life. A plot of sugarcane may house a hundred wren-warblers, which perforce have to move when that field lies fallow after the cane is cut. Movements of this type readily tend to become regular. In so many district lists one reads statements to this effect :—'This species is common in the station except during the breeding season when it retires to the neighbouring jungles.' A local movement has become standardised and, in fact though not regular, satisfies our definition of migration.

We must not overlook, either, the definite seasonal movements connected with the Himalayas (and other big ranges in other parts of the world of course). Here we have alpine conditions conforming to Arctic conditions, as they do in many other respects. Throughout the length and breadth of the Himalayas there is a vast area, roughly speaking all altitudes above 8,000 ft. and below the region of perpetual snow, which is similar to N. Siberia which we have spoken of above. In summer it is a temperate zone, rich in plant and insect life and able to support a huge population of birds. In winter snow and frost cut off the greater part of this food supply and a large proportion of the summer bird population could find no living there. A number of the species definitely migrate and we speak of them normally as migrants. There is however another batch of species which are commonly spoken of as residents in the Himalayas, though in actual fact their movements are almost as regular. The Blue-fronted Redstart (*Phœnicurus frontalis*) may serve as an example. This bird breeds in the upper zone of the forests and the lower zone of the Alpine pastures, roughly speaking 10,000 ft. to 13,000 ft. in altitude, under what in summer are most favourable conditions. In this zone in winter it cannot find sufficient food; so as the autumn frosts and snows begin, it gradually moves downhill before them, its zone in winter therefore varying in proportion to that winter's climatic conditions. As the grip of winter again loosens, it moves upwards and in due course finds its breeding zone habitable. The degree of this movement is variable, but under its influence some species in some years wander a considerable distance into the sub-Himalayan plains.

Mention must also be made of another type of local movement which helps to illustrate the strong hold which home association has for a bird, and the readiness with which a bird comes under the sway of rhythmic movement. It is particularly marked—or at any rate best observed—in the crow family. The common House Crow, for instance, sleeps in vast colonies of many thousand individuals. This dormitory is used by birds from a tremendous distance around. For an hour or so before dusk great columns of crows converge from all points of the compass, leaving again in similar columns before sunrise. Now the distance that crows travel in this manner is very great. A good account of this daily flight to a dormitory at Lahore is given by the Rev. T. Bomford (*J.B.N.H.S.*, xviii, 904) and he had reason to think that the main columns came from well over 30 miles away. In Kashmir I noticed similar columns of Jackdaws (*Corvus monedula*) at Baramullah which were evidently travelling to the dormitory in Srinagar.

Without devoting more space to these various types of movement, I think enough has been said to suggest that there is plenty of reason why many birds should migrate and there are plenty of factors in their lives from which the habit of migration might easily develop. But the difficulty is always to explain why migration in its complete form should have become the compelling and regular force that it undoubtedly is. While it is easy to see that the Blue-throat nesting up in the wastes of N. Siberia must leave that country before the approach of winter, it is not so easy to see why it must or does return the following spring. India and Ceylon contain conditions of country which suit its nesting requirements. They afford an ample supply of food in all seasons of the year. Between the plains and the highest Himalayas there is a range of temperature and climate which somewhere or other must suit the species, yet the true migrant is evidently in the grip of a compelling force. Conditions of food and security, humidity and temperature may still be the same as those that served it a few weeks before. They may serve for the breeding needs of closely allied forms which stay behind. Yet, year after year with a regularity, sometimes almost to the day, the species leaves the peace and plenty of the south and starts the dangerous and laborious journey northwards. That it should start at all seems strange, that it ever arrives at the appointed place miraculous.

What is the nature of the stimulus that starts the bird off? Various factors have been pressed into service by different writers, of which food supply and temperature seem *prima facie* the most likely. But all suggested factors are variable in their incidence while regularity is a basic characteristic of migration. There is therefore much that is attractive about Professor Rowan's recent suggestion that the explanation of the regular rhythm is to be found in day length.

Day length is now recognised as of vital importance to all creatures whose activities are directly or indirectly influenced by sunlight. Professor Rowan claims to have established that the reproductive organs of a bird are directly affected by day length. By artificially manipulating the amount of light to which a bird is exposed, the interstitial tissue of the reproductive organs may be brought into any desired stage of development. It can be advanced or retarded as compared with other individuals of the species subject to normal conditions. The hormone produced by this tissue controls sexual behaviour and migration can therefore be considered as a definite phase of reproduction, linked to it.

Professor Rowan's experiments also produced valuable circumstantial evidence. On the one hand he kept migratory species under normal conditions until winter and then released them after the tissue changes were complete. These birds did not migrate as the stimulus had then apparently passed. Other birds were kept until mid-winter under artificial conditions of light sufficient to produce a premature increase in the tissues, equivalent to that of the spring season. These birds when liberated in mid-winter disappeared at once and some of them were actually recorded as moving northwards, that is in the direction of the spring migration.

The explanation of migration suggested by these experiments is then as follows. The rhythm of the waxing and waning of the year, working through quantity of daylight hours, which control physical activity, induces a corresponding rhythm in the reproductive system. Under its urge in spring the migrant bird seeks out its ancestral home to breed. The return journey is in the nature of reflex action, the contrary swing of the pendulum. It is reinforced by the age-long threat of natural selection that the bird which does not leave will perish, a threat that is in the background for all that the conditions of the moment hold no hint of urgency.

If this explanation is accepted, one has still a difficulty about the young birds. Do their undeveloped organs reflect the adult changes and do they so connect up with the first revolution of the rhythm of nature, involuntarily as they undergo their first post-juvenal moult? Are they influenced by mass suggestion, the uneasiness of the adult hordes around them? We know very little about the order of the departure of old and young.

The second great question to answer is how birds find their way on migration. Several theories have attempted to answer this question. One writer suggests that the birds travel by a series of landmarks, known personally to all the older generations in the migrating hosts. Another suggests a cumulative inheritance of the result of experience, and many changes are rung on these suggestions.

The first point in any consideration of the question seems to be to understand the conditions under which birds travel. These are best viewed under four main headings:—

(*a*) In what manner do birds travel?
(*b*) At what altitude do birds travel?
(*c*) At what pace do birds travel?
(*d*) Does migration follow any defined routes?

The first three of these questions are evidently concerned with each other, as the height at which a bird flies, the pace at which it travels and the manner it adopts will clearly differ not only according to species but also to circumstances. Theoretically a bird travelling between two points on the map may perform the journey in one of two ways. It may start on the wing from one point and fly without intermission direct to the other point; or it may travel in a series of laps. Should the first method be adopted a fast flight high in the air would seem to be the obvious corollary. If it flies in a series of laps these may theoretically vary from a small series of high fast flights, to a long series of daily journeys performed at ease and combined with feeding. In actual fact there is probably complete gradation between the two theoretical methods.

In India the Mongolian Sand-Plover (*Charadrius mongolus*) evidently furnishes a good example of a bird which apparently migrates from its winter quarters to its breeding ground in one lap. Ticehurst (*Ibis*, 1923, p. 658) has given an interesting account of this species in its winter quarters on the mudflats of Karachi where it is the commonest wader and delays so long in its departure that the courtship may be viewed on the Karachi sands. The organs also reach full breeding size at Karachi a point unusual in migrants in their winter quarters. These birds breed on the high wastes of Ladakh and Tibet. Yet, in spite of their abundance and the amount of terrain apparently suitable for them in the great Indo-Gangetic plain, they are unknown to occur anywhere between Karachi and Ladakh. The inference is irresistible that they perform the journey in one lap. They must fly high to escape observation and also to cross the Himalayan ranges. They must fly fast to get through with the journey.

At the other end of the scale some small Passerine birds evidently travel very slowly, moving in waves that pass on day by day and night by night. A good example of this type of movement is afforded by the Tree-Pipit (*Anthus trivialis*) which swarms over the Punjab during migration in flocks which will be found feeding everywhere and which on the outer slopes of the Himalayas I have seen travelling up the hillsides in an irregular stream.

We shall probably not be far wrong in thinking that the height at which a bird flies is connected with two points, the length of the laps in which it ordinarily travels and the atmospheric and climatic conditions of the particular day. Other things being equal, large birds doubtless as a rule travel higher than small birds. That birds sometimes travel low over the face of the sea, is easily verified by all who travel in ships. The maximum height scientifically established for a small bird on migration is 2,200 metres above the nearest ground. There are however only a few records over 1,000 metres and comparatively few between 400 and 1,000 metres. The great majority of migrants journey at an altitude below 400 metres.[1]

There has been much exaggeration as to the rate at which migrants travel in direct flight. Estimates of 100 to 200 miles an hour have even been provided for some species. Modern critical work on this subject suggests that the average rate of travel of a medium-sized migrant is much more likely to be in the neighbourhood of 30 or 40 miles an hour.

It is difficult to give a short answer to the question whether migration follows any particular route. Some writers, to use Professor Newton's caustic remark, attach an almost superstitious importance to the phrase migration-route. They envisage a map of the world on which is drawn a series of great routes from the north to the south fed by a regular net-work of subsidiary tracks. Their idea is roughly that the routes exist, due in their origin to river systems, seas and mountains and that the migrants are drawn to travel along them, just as the human traveller naturally follows the road and rail system of his country. It seems however much more probable that each migrant species goes its own particular way and that a supposed migration route is only the coincidence of the ways taken by a number of species. Too often only, as well, it marks only the activities of a particular observer.

It seems obvious that if a particular species breeds in Turkestan and winters in Africa, there must be some choice of routes between the two places and that one route possesses advantages for that species over the others, while it is easy to understand that one route may be better for the autumn journey southwards and another for the return journey in spring. It is also easy to see that the comparative advantages between the possible routes may vary according to the requirements of the different species that require to make the journey. But against factors like this, which seem to tend to narrow the line of migration, one must set the fact that migrants undoubtedly travel not in column but over a tremendously wide front. Whilst one must also remember that the route of an air-borne traveller is necessarily much less definite than that of a traveller by land. This point has been very well brought out in a book entitled *This Bondage* written by Commander Acland (1929), which should be read by all who are interested in the subject. Commander Acland is no ornithologist, but he is an airman who wishes to make the students of migration familiar with the rules of travel in that moving medium, the air.

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[1] See F. von Lucanus, *Die Ratsel des Vogelzuges* (1921).

For us the chief interest of the book lies in the insistence on the difference between ground and air travel. If *A* and *B* are two places one hundred miles apart on a direct route, the traveller by ground knows in advance the exact mileage which he has to travel. It remains the same for one journey or a dozen. The traveller by air has no such knowledge. Were he to fly from *A* to *B* in a vacuum low above the earth he could say for certain that his journey would take a hundred miles. But instead of in a vacuum he travels in a moving medium, the air. His air mileage is therefore usually entirely different from his ground mileage and also varies almost every time he performs the journey, for he is at the mercy of those currents of air which we call the wind. If he flies with the wind, his air mileage is reduced; if he flies against it, his air mileage is lengthened. If the wind comes from one side or another his course becomes a segment of a circle, greater or less according to the angle and velocity of the wind and the rate of his own speed. It therefore is easily possible that in twenty journeys between *A* and *B* he may never actually fly the same course in relation to the ground below. The greater the distance between *A* and *B*, the greater possibility of variations in the courses flown and the less chance that migrating birds can travel by a series of usual landmarks.

I do not see how, in the present state of our knowledge, we can get away from the supposition that migrants travel to their destination under the influence of some directional sense which is roughly speaking of the nature of the magnetic compass. Very often no doubt the bird unconsciously follows a definite route with a definite series of customary halting places on it just as the human caravan across central Asia travels by a series of known stages. Under the influence of the sexual impulse the bird would fain return to its home, its breeding place. It starts on the journey. It makes for the old established stages, each in turn, till it arrives at its destination. It does not know why it is travelling. It is ignorant of its route or why it goes by that particular route. It travels only by the compass of the unknown sixth directional sense, following the route dictated by the past history of its species in the growth of its migrations.

This may seem fanciful but I see no reason why it should not be correct. The rudiments or the remains of such a directional sense are undoubtedly present in many human beings. I personally have always felt in forest or in unknown country a sense of direction guiding me roughly in the way I wanted to go. This is a small point but we have more definite evidence such as the classic case of the Noddies and Sooty Terns of Bird Key. This is an island of the Tortugas group which marks the northern limit of the migrations of these species. Breeding birds were caught on Bird Key and marked. They were then taken in closed baskets by steamer to Galveston in Texas more than 800 miles away over seas which the birds had probably never traversed in their lives. Some returned in six days, others took longer and some never returned at all. Further experiments of a similar nature were made, varying in detail, and in all of them a satisfactory proportion of the birds returned to their nests. The actual details of the experiments are worth study but there seems no doubt that it was clearly proved that untrained birds could return successfully from a distance of 800 to a 1,000 miles over the apparently trackless sea. The supposition that they were guided by some such sense as I have postulated, seems easier than any other possible suggestion as to the manner of their return.

I should like to have ended this chapter by a brief account of the chief directions in which the stream of migration travels over India between the Himalayas and Ceylon. But the long and short of it is that the material does not yet exist which would allow such an account to be written. After collating all the records in India of a great number of species and plotting the result on maps I have come to the conclusion that it is not yet possible to write an accurate account of the movements of any of our Indian migrants. The number of observers has been too small. The blank spaces on my maps too often represent not the absence of the species but merely only the absence of an observer. There is one exception only. We have a very fair knowledge of a stream of migration which passes through the N.-W. Frontier Province, the Punjab and Sindh as it has been recorded in numerous papers in the *Journal* of the Bombay Natural History Society and the *Ibis*. This exists as a nucleus which we may hope, will be gradually extended by observations in other parts of India. For it is already clear that each species has fairly defined routes in India and they are worth investigation and record. In Europe and Asia a great deal has been learnt during the present century by the practice of 'ringing' birds. This system is very simple in theory but depends in practice on the collaboration of a large number of 'ringers' and on the general good will and interest of the public. Success depends on the handling of as many individual birds as possible, whether as adults or as young in the nest. A light aluminium ring is placed on one leg of the bird. On it is engraved an individual serial number and the address to which the recovery of the ringed bird is to be intimated. A record is kept of all rings and numbers of the species ringed and of the date and place where the bird was ringed. The recovery of a bird bearing one of these rings immediately supplies an isolated but authentic fact regarding the movement of an individual bird. To quote an instance from a recent

Journal (vol. xxxv, p. 457), a Rosy Pastor (*Pastor roseus*) was shot at Lahore, Punjab on 28 April 1926. It bore a ring number 27381 of the Royal Hungarian Institute of Ornithology which was forwarded to the address given on the ring. It was established at the bureau that this particular Pastor was ringed as a nestling in N.-E. Hungary on 30 June 1925. The direct air distance between these two places is 3,000 miles and we are at once in possession of certain absolutely authentic facts—worth any amount of theories—regarding the migration of the Rosy Pastor. As such recoveries multiply, our knowledge increases. Certain very definite facts are already beginning to emerge regarding the migrational movements of the British Isles from the accumulation of these records, and now that the practice of ringing is in full swing, the records grow in number and so in value.

A NEW GENTIAN FROM N. WAZIRISTAN.

BY

E. BLATTER, S.J., Ph.D., F.L.S.

Gentiana Lowndesii [1] Blatter, *spec. nov.*

[*Gentianacea pertinens ad sectionem Pneumonanthe* Neck. *Caules simplice-vel ramosi internodiis brevibus ad 2 5 cm. longis ad 11 cm. alti. Folia radi, calia lineari-oblonga apice subobtusa, coriacea, ad 4 cm. longa, 8 mm. lata 1-nervosa, caulina vero lineari-subspathulata, apice acuta, basi connata tubum brevem formantia. Flores usque ad 4 numerantes axillares et terminales, 1-2 pedicellati in axillis superioribus. Calycis tubus ad 1·5 cm. longus, non carinatus ; lobi 5, subæquales, lineares, acuti, 6-9 mm. longi. Corolla cyanea, 4·5 cm. longa, ad dentes ca. 2 cm. lata, plicis aucta tubo 3–3·5 cm. longo, lobis 5 subæqualibus, usque ad 1 cm. longis et basi 5-8 mm. latis, triangulari-lanceolatis vel ovatis, acuminatis vel cuspidatis. Stamina 5, libera, inclusa, in fructu immaturo persistentia ; filamenta applanata, parte $\frac{2}{3}$ inferiore multo largiore ca. 2 mm. lata. Ovarium 1-loculare, stylo brevissimo, stigmatibus linearibus demun revolutis 3-4 mm. longis. Capsula ad 3 cm. longa, 5 mm. lata pedicello 1 cm. longo ; semina non visa.*]

Rootstock stout, perennial. Flowering stems simple or branched up to 11 cm. high. Internodes of stem short, up to 2.5 cm. long, purplish. Radical leaves forming a dense cluster, linear-oblong, leathery, up to 4 cm. long by 8 mm., subobtuse at the apex, 1-nerved. Cauline leaves up to 3 cm. by 3-4 mm., linear-subspathulate, acute, glabrous, united at the base, forming a short tube about 5-7 mm. long. Flowers up to 4 on each plant, bell-shaped, terminal and axillary, 1-2 stalked in the upper axils. Calyx-tube up to 1.5 cm., not keeled. Lobes 5, linear, acute, subequal, 6-9 mm. long, united up to end of tube by scarious tissue. Corolla sky blue, 4·5 cm. long, 2 cm. broad ; tube 3-3·5 cm. long. Lobes 5, subequal, up to 1 cm. long, 5–8 mm. broad at the base ; triangular-lanceolate or ovate, acuminate or cuspidate, folds between the lobes, throat milky-white-dotted. Stamens 5, free, included, persistent in young fruit ; filaments flattened throughout, lower $\frac{2}{3}$ much broader measuring about 2 mm. in diam., anthers large, 4 mm. long. Ovary 1-celled ; style very short, stigmas linear, curved outwards, crozier-shaped, 3-4 mm. long. Capsule up to 3 cm. long, 5 mm. broad, stalk about 1 cm. long. Seeds not seen.

Note : This species is related to *G. Kurroo* Royle and *G. decumbens* Linn. f. From the former it can be distinguished by the branched stem, the shape of the corolla-lobes and the much larger capsule. It differs from *G. decumbens* by the stem being branched, by the calyx-lobes not being very unequal, by the corolla-lobes not being rounded and by the flowers being stalked.

Loc. : N. Waziristan : Alexandra Ridge, 7,800 ft. (Capt. D. G. Lowndes No. 2430, type).—Flowered in October 1931. This species is found plentifully on open hill-tops, 7,500–8,500 ft.

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[1] After Capt. D. G. Lowndes who found this plant.

ON A COLLECTION OF GROUND BEETLES (CARABIDAE) FROM WAZIRISTAN.

BY

H. E. ANDREWES.

In the spring of 1930 (March and April) an Excursion, organized by St. Xavier's College, Bombay, under the direction of the Rev. Dr. G. Palacios, visited the little-known region of Waziristan. The Carabidae found there were sent, with other insects, to the British Museum, and I have been asked to give some account of them. Twenty-one species are included in the collection, and all but one of these are referred to below; a solitary specimen of a *Lebia*, unknown to me, is in such poor condition that I cannot deal with it here. Of the remaining twenty species two are confined, so far as I am aware, to eastern Central Asia, twelve are found in the Himalayan region of North India, and six are new. An enumeration of the species follows, after which will be found the descriptions of the new ones; the type specimens of the latter will be placed in the British Museum.

1. *Calosoma maderae* F. Syst. Ent. 1775, p. 237 var. *auropunctatum* Herbst in Arch. Ins.—gesch. (Fuessly). v. 1784, p. 131; Andr. Faun. Brit. Ind. Carab. i. 1929, pp. 51 and 58.

1 Ex. Both the type-form and the variety are widely spread through the palaearctic region; the former has not yet been found in India, but the latter is common in the North-West.

2. *Scarites granulatus* Andr. Faun. Brit. Ind. Carab. i. 1929. pp. 231 and 256.

1 Ex. I have previoulsy seen only two examples of this species, one from Pusa, the other found in Bengal on the banks of the Brahmaputra River. In the specimen from Waziristan the head is more coarsely striate than in the type.

3. *Scarites limitaneus* sp. n. (See p. 863).

4. *Bembidion insidiosum* Solsky in Fedchenko's Reise in Turkestan ii. pt. v. 1874, p. 130. Razmak.

1 Ex. I have not seen the type, but the example agrees with a specimen from Buchara in my collection; the species is not at present known from India.

5. *Bembidion waziristanum* sp. n. (See p. 863).

6. *Bembidion palaciosi* sp. n. (See p. 864).

7. *Tachys tetraspilus* Solsky in Fedchenko's Reise in Turkestan ii. pt. v. 1874, p. 114; Andr. Revision of the Oriental species of the genus *Tachys*, Ann. Mus. Civ. Gen. li. 1925, pp. 404 and 433.

3 Ex. Found both in Central Asia and North India.

8. *Chlaenius hamifer* Chaud., Bull. Mosc. 1856. ii, p. 209.

1 Ex. Very common throughout South-East Asia.

9. *Chlaenius lederi* Reitt., Deutch. Ent. Zeitschr. 1888, p. 417.

1 Ex. A Central Asian species not hitherto met with in India.

10. *Chlaenius tenuelimbatus* Ball., Bull. Mosc. 1870. ii, p. 326.

3 Ex. The species is known from Central Asia and Kashmir.

11. *Licinus corustes* sp. n. (See p. 864).

12. *Acinopus laevigatus* Mén., Cat. rais. 1832, p. 128.

1 Ex. A fairly common insect, met with in Central Asia, Persia, and Kashmir.

13. *Harpalus melaneus* Bates, Proc. Zool. Soc. Lond. 1878, p. 714; id., Scientific Results of the Second Yarkand Mission, Col. 1891, p. 6, t. 1. f. 4.

Razmak, 1 Ex. Common throughout the western half of the Himalayan tract. In the Waziristan example the puncturation of the prothorax is very much reduced, but Dr. Schauberger informs me that he has in his collection specimens from the Chinese Province of Szechuen, in which this character is a very variable one.

14. *Harpalus confinalis* sp. n. (see p. 865).

15. *Amara* (*Leiocnemis*) *himalaica* Bates, Proc. Zool. Soc. Lond. 1878, p. 716; id., Scientific Results of the Second Yarkand Mission, Col. 1891, p. 14.

Razmak, 4 Ex., varying somewhat in their characters, and mostly in poor condition. Confined to the mountainous region of North-West India.

16. *Sphodrus indus* Chaud., Bull. Mosc. 1852. i, p. 67.

1 Ex. Found only in the mountains of North-West India.

17. *Pheropsophus catoirei* Dej., Spec. Gen. i. 1825, p. 301.

7 Ex. Common throughout India and in Ceylon, but much commoner in the north than in the south.

18. *Metabletus fuscomaculatus* Motch., Ins. Sib. 1844, p. 59.

1 Ex., but a second fragmentary specimen probably belongs to the same species. The numerous forms of this very variable species are widely spread over the southern palaearctic area, extending from Madeira on the west, through the Mediterranean region, to Central Asia and the Himalayas.

19. *Metabletus ephippiger* sp. n. (see p. 865).

20. *Cymindis glabrella* Bates, Proc. Zool. Soc. Lond. 1878, p. 719; id., Scientific results of the Second Yarkand Mission, Col. 1891, p. 20, t. 1. f. 17.

1 Ex., immature and crushed, but belonging apparently to this species, which has been known hitherto from Kashmir only.

Scarites limitaneus sp. n.

Length : 21–23 mm. Width : 5·75–6·5 mm.

Head with the lateral truncature straight, the preocular angle hardly projecting laterally, frontal impressions shallow, surface moderately striate in front, nearly smooth behind ; mandibles rather small, finely striate, median carina strongly sinuate, left mandible with a wide basal tooth, right one with two teeth, eyes flat, genae shorter than eyes, projecting as far laterally ; antennae reaching hind angles of prothorax, joints 5 to 10 hardly longer than wide ; mentum rugose-striate, granulate at base, a median carina from apex of tooth to base, a lateral carina on each side near margins of lobes. *Prothorax* about a fifth wider than head and a fourth wider than long, base hardly produced, but with an obtuse angle at each end of the median part, its sides nearly straight, front angles each projecting forward as a small tooth, sides bisetose, curved near front angles, thence gently contracted, with a well marked tooth at each hind angle ; median line fine, front transverse impression deep at sides, subinterrupted at middle, vaguely crenulate, basal foveæ just indicated and lightly granulate. *Elytra* evidently dilated behind, their width increasing from 5·25 mm. at base to 6·25 mm. at apical third, where they are as wide as prothorax, four-fifths longer than wide, base granulate, emarginate at middle, its sides straight and rather strongly oblique, shoulders dentate ; striae lightly crenulate, shallow at middle, much deeper at sides, especially near shoulders ; intervals flat, convex behind shoulders, where 6 and 7 are narrow and subcostate, 3 with two pores near apex, granulation confined to interval 8 and marginal channel, that often present along the sides of the striae obsolete ; surface smooth, apical half dull, covered by an isodiametric microsculpture. Underside impunctate ; metepisterna twice as long as wide ; protibiae with 2 to 3 denticulations above upper tooth ; mesotibiae with two equal spurs.

Allied to *S. salinus* Dej., but smaller. Head similar, but with the antennal joints shorter ; prothorax relatively wider, its sides less parallel, sides of base usually straighter ; elytra evidently dilated behind (nearly parallel in *salinus*), the striae much less impressed, with hardly a trace of granulation along their sides, interval 8 not costate or coarsely granulate behind shoulder, the sides of the basal border more oblique.

Waziristan (without exact locality), 5 Ex.

Bembidion waziristanum sp. n.

Length : 5·5–6 mm.

Black : upper side rather faintly aeneous, palpi ferruginous, first joint of antennae, legs (except base of femora), and a vague apical spot on each elytron dull red.

Head with single deep parallel furrows, extending to sides of clypeus, neck wide, eyes rather flat, antennae rather thick, reaching basal third of elytra, surface vaguely rugose between the furrows, with a few fine scattered punctures behind. *Prothorax* convex, cordate, about a fourth wider than head and as much wider than long, extremities equally contracted, sides rather strongly rounded in front, sinuate a little before base, the marginal channel widening a little on basal half, hind angles sharp and rectangular, with a well developed carina ; median line and transverse impressions all moderately deep, basal foveae deep, surface smooth, basal area finely and irregularly punctate. *Elytra* moderately convex, oval, a half wider than prothorax, three-fifths longer than wide, border at base reaching stria 5 ; striae moderately deep and very clearly punctate, much shallower, though visible, at sides and apex, 3 to 6 only disappearing just before apex, 2 shallow but visible near apex, 8 deep, joining 9 at basal third, scutellary striole fairly long, apical stria moderately deep, joining 7, the pore in the stria ; intervals somewhat convex on disk, otherwise flat, the two dorsal pores on the inner side of stria 3. Microsculpture of elytra formed by fine strongly transverse meshes, none on prothorax or head, except on labrum and neck, where there are isodiametric meshes. Underside impunctate . metasternal process bordered.

Allied to *semilotum* Net., a little smaller and aeneous instead of blue. Head with deeper furrows, surface smoother and less punctate, eyes flatter ; prothorax wider, with wider lateral channels, surface less punctate ; elytra less contracted towards base, striae a little deeper with rather larger, clearer punctures, microsculpture of elytra similar, but none visible even on sides or base of prothorax.

Razmak, 6 Ex.

Bembidion palaciosi sp. n.

Length : 4·75 mm.

Piceous : head and prothorax blue ; palpi, antennae, and legs flavous, elytra each with two large ferruginous spots, nearly meeting at middle.

Head with single deep parallel wide furrows, extending to clypeus, subinterrupted opposite clypeal suture, eyes prominent, antennae slender, surface with a few scattered punctures behind. *Prothorax* convex, cordate, only a little wider than head, a fourth wider than long, extremities equally contracted, sides strongly rounded in front, sinuate close to base, marginal channel very narrow, hind angles sharp and rectangular, with a short carina ; median line and transverse impressions all moderately marked, basal foveae small but fairly deep, surface nearly smooth, basal area finely but clearly punctate. *Elytra* moderately convex, ovate, about two-thirds wider than prothorax, three-fifths longer than wide, widest behind middle, border at base reaching stria 5 ; striae moderately deep and very clearly punctate, much shallower at sides and behind, 2 quite distinct to apex, 7 almost invisible, 8 deep, joining 9 at a fourth from base, scutellary striole fairly long, apical stria rather short, joining 5, the pore in the stria ; intervals somewhat convex on disk, flat elsewhere, the two dorsal pores on stria 3. The microsculpture of the elytra is formed by very fine wide meshes ; the head and prothorax are without any on disk, but meshes are visible on sides and base of prothorax, and also on the neck. Underside impunctate ; metasternal process bordered.

Closely allied to the Central Asian *abbreviatum—dilutipenne—persicum—marginipenne* group, but the elytra are more clearly and deeply punctate-striate than in any of them. The elytra have exactly the pattern of *pamirense* Bates, but the head and prothorax are blue ; head with deeper frontal foveae, and much more prominent eyes ; prothorax a little wider, with more strongly rounded sides, the base punctate, but not rugose ; elytra with rather deeper striae, also slightly larger and deeper punctures.

Razmak, 4 Ex.

Licinus corustes sp. n.

Length : 9·5–10 mm. Width : 4–4·2 mm.

Black, rather dull, especially the elytra, apex of palpi dull red.

Head short, flattened in front, the foveae rather shallow, substriate, labrum only slightly emarginate, but strongly asymmetrical, clypeus bisetose, deeply emarginate, exposing the basal support of the labrum, which is not membranous and which is separated from the labrum by a deep sulcus, a transverse ridge in front of the clypeal suture, to which the curved emargination of the clypeus is almost tangential, antennae thickly pubescent from and including joint 4, joint 1 as long as 2 + 3, and a little thicker than the other joints, eyes rather flat, surface finely and not very closely punctate. *Prothorax* cordate, rather flat, a half wider than head, a fourth wider than long, extremities equally contracted, moderately emarginate, sides bisetose, bordered, slightly but rather widely explanate, rounded in front, straight behind, hind angles strongly rounded and slightly reflexed ; median line fine, becoming deeper and widening out behind, but not reaching base, front transverse impression shallow, basal foveae moderately deep, disk and front margin finely and sparsely punctate, surface otherwise rather coarsely and closely punctate. *Elytra* oval, moderately convex, a distinct emargination on each side before apex, striae fairly deep, and closely punctate, a little shallower near apex, intervals moderately convex, rather sparsely and irregularly punctate, the punctures more evident on the odd than on the even ones, the marginal series larger, along the middle of interval 9, marginal channel closely punctate. Microsculpture isodiametric, very distinct on the elytra, hardly visible on the head or on the disk of prothorax. Sterna and sides of venter at base finely punctate, the metepisterna and sides of metasternum more strongly punctate. Metepisterna a half longer than wide ; both pro- and meta-sternal processes bordered.

Smaller than *astrabadensis* Reitt., the head much smaller, the prothorax much more contracted behind, the elytral striae deeper, and the intervals more convex.

Razmak, 2 Ex. ♂ ♀, unfortunately not in very good condition.

Harpalus confinalis sp. n.

Length : 7·5–8 mm. Width : 3–3·2 mm.

Black, moderately shiny : palpi and joints 1 and 2 of antennae ferruginous, rest of antennae fuscous, tarsi piceous.

Head convex, smooth, clypeal suture very fine, frontal foveae small, eyes not prominent, antennae slender, reaching just beyond base of prothorax, tooth of mentum very short and obtuse. *Prothorax* convex, subquadrate, very nearly a half wider than head, and about as much wider than long, base bordered, much wider than apex, sides unisetose, finely bordered, well rounded in front, nearly straight behind, without trace of sinuation, hind angles right and slightly rounded, median line very fine, transverse impressions vague, basal foveae small, very lightly punctate, a few punctures extending to hind angles and lateral channels, basal and apical areas rather uneven, middle of base slightly longitudinally striate. *Elytra* convex, subovate, barely wider than prothorax, a little more than a half longer than wide, shoulders with a rudimentary tooth, apex moderately emarginate on each side striae impunctate, rather fine, though clearly impressed, intervals nearly flat, 3 with a pore at apical fourth, 9 with a series of small punctures in addition to the larger ones of the marginal series bordering stria 8. Microsculpture isodiametric, barely visible on head and disk of prothorax. Underside smooth, prosternal process glabrous, metepisterna a half longer than wide, base of venter finely punctate and setulose, last 3 segments smooth, apical segment ♂ with two marginal setae on each side, metafemora plurisetose.

About the same length as *H. anxius* Dufts., but wider, prothorax more rounded in front, so that the front angles are less evident, a little contracted behind (parallel in *anxius*), elytra wider, similarly striate, the humeral tooth rudimentary.

Waziristan (without exact locality), 4 Ex. ♂♂.

Metabletus ephippiger sp. n.

Length : 2·7 mm.

Flavous : prothorax and neck red, head, a deep median band on the elytra, covering nearly a third of their surface, produced along suture to base in front, and for a short distance behind, apex of elytra, and apex of venter piceous.

Head without any distinct frontal foveae, surface very distinctly but not closely punctate, eyes rather flat, mentum with a short obtuse tooth, antennae submoniliform. *Prothorax* cordate, just wider than head, not quite a half wider than long, base produced at middle, its sides oblique and emarginate, apex slightly emarginate, front angles adjoining neck, sides bisetose, finely bordered, well rounded in front, sinuate a little before base, the hind angles sharply rectangular and a little reflexed ; median line and hind transverse impression moderately deep, front transverse impression obsolete, basal foveae slight, surface, like that of head, sparsely punctate. *Elytra* flat, gradually dilated behind and widest not far from apex, four-fifths wider than prothorax, about a third longer than wide, truncate behind, leaving the abdomen exposed ; striae so lightly impressed as to be barely visible, though nevertheless containing microscopic punctures, intervals flat, 3 with a minute pore at a third from apex, adjoining stria 3, a large umbilicate pore on each side of scutellum ; surface with a few almost invisible scattered punctures. Microsculpture of prothorax and elytra formed by very wide meshes, that of head isodiametric. The pectination of the claws is very slight.

A little larger than *M. myrmidon* Frm., the prothorax red, the pale area on the elytra more extensive, the head and prothorax conspicuously punctate, the elytra with less evident striae.

Waziristan (without exact locality). 1 Ex.

FISHING FOR 'BOMBAY DUCK' (*HARPODON NEHEREUS*).

DESTRUCTIVE NETTING METHODS.

BY

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(*With 1 plate and 2 text figures.*)

The object of this paper is to place on record a few observations regarding the trade in 'Bombay duck' or Bombils (*Harpodon nehereus*), the methods of their capture and the manner of their disposal for commercial purposes. This paper is meant to be only an outline of suggestions for the future development of this valuable fishery. It is not a survey of the entire industry round Bombay, but is confined to the data gathered at Colaba only, which, during the monsoon is the main fishing centre for this fish. The first thing that strikes the observer is the appalling waste of the fish and the reckless and primitive methods used in fishing for them.

The paper deals with special reference to these two features, for the present writer, who has personally accompanied the fishermen in their operations, feels that the introduction of more modern methods would enable the fishery to be put on a more organised basis. For this reason it would be best to begin by referring to the existing methods of obtaining the fish.

The peak period of the fishing season in Bombay (for 'Bombay duck') is from June to September, and at this time the inshore waters are the haunts of innumerable kinds of fishes, both large and small, and crustaceans.

The net employed to capture the fish is a device known as the bag net, which in the vernacular (Marathi) of the fishermen is called the *dōl.* The bag, which is of heavy cotton netting, is conical in shape, the base, which is the open end, being rectangular. The length of the net from the rim of the base to the tapering closed end is about 150 feet with a circumference at the mouth varying from 180 to 230 feet. The mesh of the net is not uniform throughout. At the mouth, the net has large meshes, which are about four inches in diameter. As the net tapers, the meshes become smaller in size and, towards the end are so narrow that the escape of the tiniest fish is rendered almost impossible. A peculiar feature of the meshing is that with the inrush of the water the interstices get completely closed. The net then resembles a hermetically closed cone. The pressure at the tapering end is very great both as a result of the inrushing water and the catch which is driven into it. In order to withstand this dual pressure this portion of the net is double (consisting of one bag enclosed within the other). Four men are usually required to operate-the net, and when the sea is very stormy, the services of a fifth man are at times requisitioned.

METHOD OF SETTING NET.

The net is worked entirely by the tides. It is set in the water, but in such a position as to face the incoming current. As the tide starts to recede, the position of the net is reversed, the open end now facing the shore. The object in both cases is for the fish to be propelled into the net by the force of the current.

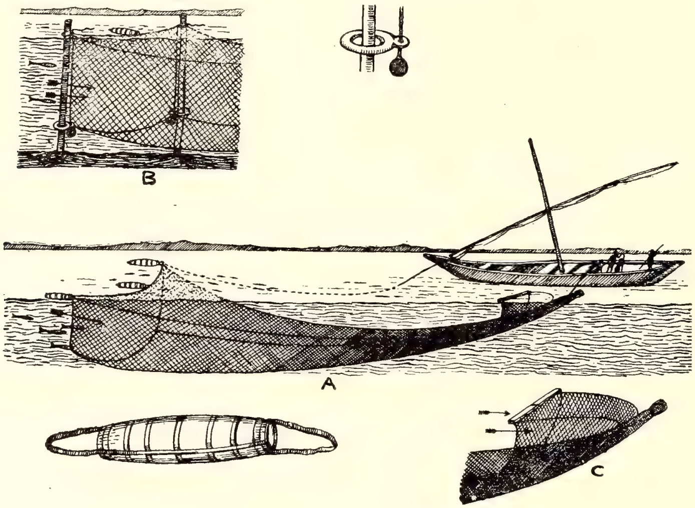
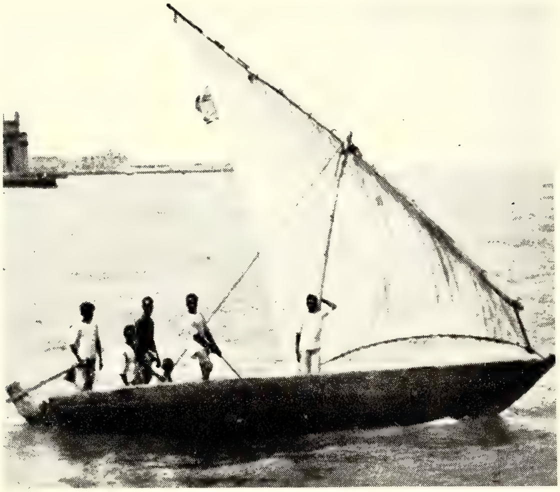


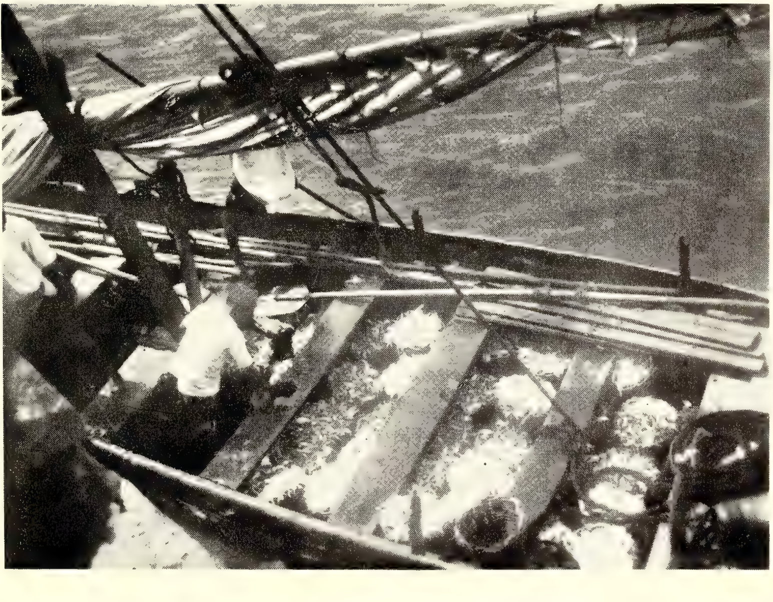
FIG. 1.

A complete "dōl" outfit. The dōl as used, (*a*) for inshore fishing; (*b*) for fishing in deeper waters; (*c*) the clever device known as "khuda" referred to in the text.

In setting the net, the top ends of the mouth are fastened to large buoys, which are permanently fixed by chains to huge rocks at the sea bottom. Besides this, the centre of the upper edge of the mouth is secured to a temporary float, which prevents the top of the net from sagging. The lower edge of the net hangs freely, the pressure of the rushing current keeping the mouth wide open. The fish are thus captured by being driven into the tapering or bag end, the opening there being closed with a rope knotted round it. The rope is long enough to enable the bag to rest on the sea floor. The fishermen are present on the grounds during the fishing operations and usually take a location in proximity to the bag end. In order to prevent the boats from being swept away from the scene of the fishing operations, a rope is tied from the bow of the boat to one of the fixed side buoys. This is the method followed in the case of the inshore fishing. In deeper waters a similar course is followed except that the place of the side buoys chained to the sea bottom is



A Bombay fisherman's sail boat as employed in the Bombay Duck fishery.



A boat come back to shore with a part of the day's catch. During the height of the fishing season many tons of fish were landed in the course of a day.

taken by two long and stout palisades, each about 100 feet in length and ten feet in diameter. These stakes are upright and formed by binding a few tree trunks till they are of the required length. They are then driven about twenty-five feet deep into the sea floor and the vertical sides of the net are attached to them. A buoy is secured to the upper edge of the mouth, as in the case of the inshore fishing, in order to prevent sagging. The time of fishing whether inshore or in deeper waters, varies from day to day, depending on the tides.

DEVICE TO PROTECT CATCH.

The description of the *dōl* would be incomplete without reference to a clever device (known in Marathi as the *khuda*) of the fishermen to protect their catch from the depredations of sharks and other larger fish which feed on smaller ones. The ravages of these fish are not only confined to attacking the smaller fish, but also extend to ripping open the net and thus affording a means of escape to the catch. In order to safeguard themselves against this menace, the fishermen have devised a semi-oval net whose purpose is to prevent larger fish from entering the bag net. The upper side of the *khuda* is secured to a rod, which by floating keeps the mouth open. Its entire under surface is tied to the four corners of the dorsal surface of the bag end of the *dōl.* The large fish are trapped in this and thus the fishermen derive a dual advantage inasmuch as these nets protect their catch as well as prevent the possibility of damage to their nets. Moreover the fish trapped are a good source of revenue as they also are sold for edible purposes.

The most serious drawback to this net is that it is non-selective in action. All kinds of fish are gathered irrespective of their size or commercial utility. The resultant wastage of this method is appalling, the nets often taking very many more fish than are required to supply the local demand for fresh fish. The method thus obviously entails the destruction of thousands of 'Bombay duck' daily which die long before they are rejected, for the fish are pressed to the bottom of the bag where they are lumped into a huge mass. They seldom recover and even if they do, they are thrown overboard together with the dead specimens.

RUTHLESS DESTRUCTION OF CATCH.

This ruthless destruction lasts not only during the season, when there is a demand for 'Bombay duck' but continues long after pomfrets, prawns and other better varieties are in season and the demand for 'Bombay duck' has long ceased. As the close of the monsoon approaches, there is a sharp falling off in the quantity of the catch of these fish and inshore fishing is gradually discontinued until in October no one fishes for them. Moreover, even during the peak period when there is a demand for them, none but the largest individuals are taken. The smaller ones, which are commercially useless, are cast overboard. Such a state of affairs would not be tolerated in any of the countries of Europe and

America, where the fishery laws lay down the different gear required in fishing for various fishes and prescribe the standard gauge of meshes for each of them.

In October the Bombay ducks decrease decidedly in abundance, the inshore fishing season ceases by the middle of October and the fishermen now venture further out into the deeper waters in pursuit of pomfrets and other bigger fish. The usual fishing grounds are near Khandairy about 25 miles away from Bombay. Here again, in addition to the drift nets used for pomfrets, the *dōl* is employed, as it is more convenient and is a labour-saving device. It often happens that besides other fish, the *dōl* takes in 'Bombay duck' but these are usually discarded as there is no demand. Moreover there is the risk of putrefaction as the fish is very delicate and the boats have to make a tedious journey of 25 miles. Sometimes the whole catch consisting of pomfrets, 'Bombay duck' and other fish have to be thrown away when the boats are becalmed, as they depend chiefly on wind and sail for their progress.

COLLECTION OF STATISTICS.

The statistics collected by the present writer during the current year give but an inadequate idea of the relatively meagre quantity to Bombay ducks that find their way into the market in proportion to the huge amount captured annually.

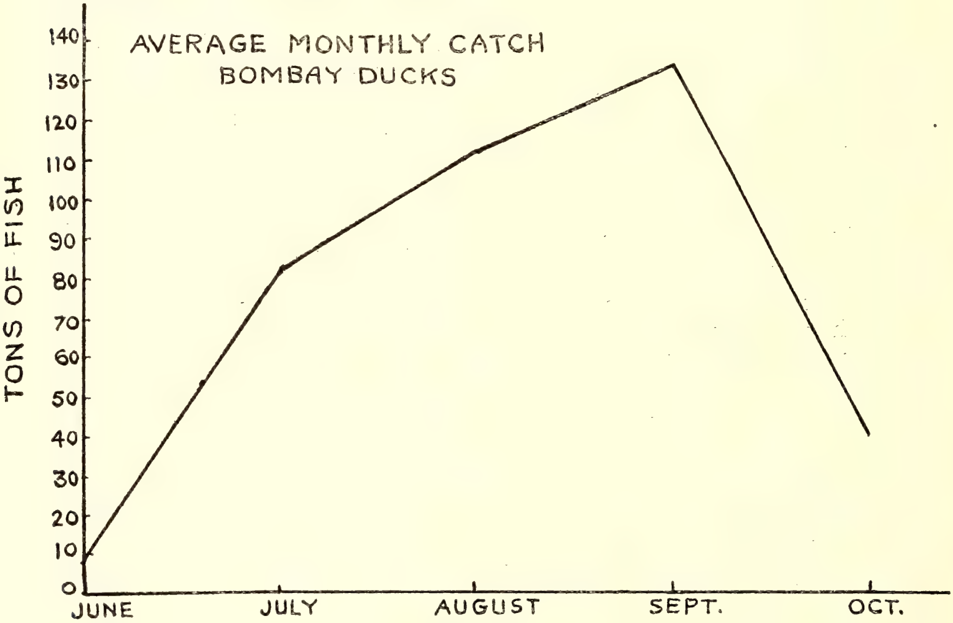


FIG. 2.

During the inshore fishing season at Bombay in 1931 (this year the fishing season began on June 16 and ended somewhat later than usual on about October 15), fifty boats owned by nineteen individuals were engaged in fishing. The average catch per boat per day was 12 baskets (all of an identical size), each having a containing capacity of about 150 fish. The average catch per day of each boat during the period referred to above, was computed by adding up the daily catches of each boat made during that time. In calculating the average, only those days on which there were any catches, were taken into consideration. On some days the catch was very poor, on others the fishermen did not go out, either on account of repairs to nets or on account of holidays or the condition of the sea. Some boats brought bigger catches than the others, because they either used larger nets or employed more men. In order to collect the statistics, the writer visited once daily, and sometimes even twice, the landing site of the fish. In his absence, a man was deputed to be on the spot and ascertain the catch as soon as it was landed. The weight of the fish was calculated by determining with a spring balance the number of fish that went to a pound and dividing the entire number of fish by the number that made up a pound.

As soon as the fish were brought to the shore, they were sorted out, the larger ones, which had a marketable value were retained, while those, which were smaller in size or had been damaged in the net were discarded. The fish were auctioned on the wharf and fetched on an average eight annas per basket during June, July and August. The value declined in September and the diminution in price steadily continued with the approach of the end of the season when the supply considerably exceeded the demand. The fishermen then contrive to secure fewer Bombay ducks from the fishing grounds and this they do by opening the bag end and letting large quantities of fish (mainly Bombay ducks) run out into the sea. Despite this drastic measure to curtail severely the supply, the number of fish obtained was large and there were frequent occasions on which baskets were disposed off at the rate of an anna each. These prices, which the middlemen paid the fishermen, are thus very much cheaper than those charged to the consumers. The consumers hardly get the benefit of the low prices and owing to the indifferent sales methods and lack of organisation, large quantities of fish are not seldom destroyed. It is regrettable that such wasteful and wanton loss of fish should be tolerated. This scandalous waste could in a large measure be obviated by improving the method of catching fish with the *dōl*, the use of which under the present conditions is an intolerable scandal and grave menace to the very existence of the fish as well as to the fishing industry.

NEED OF PROTECTIVE MEASURES

Every civilised country has its own fishery laws and the facts set forth above indicate the urgent need of introducing some protective measures to safeguard our industry if not against depletion, at least against the wastefulness and destruction of fish consequent on the above methods. It is an unfortunate fact that no fishing laws are operative in Bombay waters, and there are no means of ascertaining with any degree of accuracy the actual quantity of fish wasted.

It would be needless to raise the question of depletion and it would not be scientific to take remedial steps before there are actual indications of depletion. There are also no records showing the annual catch of any fish. Without such information no definite statement can be made. The writer has no doubt that, notwithstanding this ruthless destruction, quantities of fish several times the amount referred to above, are available. The Bombay duck fishery is capable of furnishing several times the amount mentioned in case a demand should arise. The writer would therefore suggest that a small business could be built up at Colaba by utilising such fish and others unsuitable for the market for the manufacture of fish oil and fish manure. This observation far from denying the prevalence, along the coast, of the manufacture of fish manure, though the method followed in this respect is crude or of drying Bombay ducks for the off-season, is meant to call pointed attention to the need of placing our Bombay duck industry on a scientific basis. The fish manure would be of great benefit to the agriculturists. It is hardly necessary to emphasise once more the pressing importance of modifying the construction of the *dōl* so as to give small-sized fish a chance of escaping, by making the mesh conform to a standard gauge. At the same time, intensive fishing with the *dōl* over small areas—a method very destructive to the fish and detrimental to the interests of the fishermen—should be discontinued.

NOTES ON THE FAUNA OF BRITISH INDIA: BIRDS.

VOLS. IV, V AND VI. (*New edition*).

On page 468 *et seq.* of vol. xxxii of this Journal, Dr. C. B. Ticehurst has published some notes in *The Fauna of British India*, vols. iv, v and vi, and I have been asked by some of my friends to reply to this review. As a matter of fact it appears to me that very little reply is necessary. Dr. Ticehurst has written his notes in response to an '*urgent* demand' by the Editors of the Journal and at the request of other friends. The first of these volumes was published early in 1927, vol. v, in March 1928 and vol. vi, in March, 1929, and Dr. Ticehurst's 'urgent' notes were published on the 15th of July, 1930.* As a matter of fact my own vol. vii, published some four months earlier than this, contains practically all the corrections shown to be necessary by Dr. Ticehurst, whilst the corrections to the latter half of vol. vi, and the corrigenda and addenda to the whole series were also in print at the time. Dr. Ticehurst very kindly forwarded to me his notes written for the Journal and I pointed out to him that with two exceptions the whole of these corrections were incorporated in vol. vii, which had already appeared or were in print in preparation for vol. viii. Dr. Ticehurst's review, therefore, seems to have been entirely unnecessary and for the most part is merely a repetition of the corrections which had already appeared in vol. vii of my own work.

It is true that I have not drawn attention to the misprints which occur unless these require to be pointed out because they might otherwise be misleading. Misprints which are obvious I have left to the intelligence of my readers. Misprints are bound to occur in any book or paper, however well written or edited—indeed even in the article in which Dr. Ticehurst calls me to account for my misprints, the same frequently occur.

Naturally, I much regret that it should have been necessary to publish in vol. viii so long a list of corrigenda and addenda, far more numerous and many of far more importance than any of those alluded to by Dr. Ticehurst, but it must be remembered that Ornithology is a science which is progressing and systematists and nomenclatorial experts are constantly finding facts in relation to classification as well as mistakes in nomenclature which have to be recognized and corrected. This is not a work of one man but of many and it is only by very slow degrees that we can advance towards the perfection at which we are all aiming.

In my preface to vol. iii, I have advised all the readers of *The Fauna of British India* carefully to correct the first six volumes with the help of the eighth and so accustom themselves to the nomenclature accepted in the latter as most up to date. I do not imagine for a moment that my nomenclature or my classification is final but it will at least serve as a basis by which writers can name their birds, more especially those writers who do not pretend to seek further into the mysteries of modern nomenclature.

E. C. STUART BAKER.

UPPER NORWOOD,
November 1, 1930.

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*We are afraid that the Editors of the Journal are responsible for the late appearance of Dr. Ticehurst's review and Mr. Baker's reply. The review was sent to the Society on the 8th November 1929 and was published in July 1930, Vol. XXXIV, No. 2.

The delay in publication was due to the fact that Dr. Ticehurst's notes were received when Vol. XXXIV, No. 1, published in March 1930 was already in the press and publication was held up for the subsequent issue.—EDS.

EDITORIAL.

THE RETRENCHMENT OF THE SCIENTIFIC SERVICES IN INDIA.

For some months past, as the members of the Bombay Natural History Society are doubtless well aware, the Government of India has had under consideration the question of the retrenchment of the Government Scientific Services in India. The proposals of, and the orders passed by, the Government up to the present time are of such a drastic character that they have evoked strong protests from civilised countries all over the world, both from individual scientists of international reputation and from scientific and other learned societies; and we feel that the Bombay Natural History Society cannot allow these proposals to be put into effect without adding its protest to the chorus that has already reached the Government.

That the present financial situation renders some curtailment of expenditure on the part of Government necessary cannot be denied, but it is essential to the future development and well-being of India that such curtailment should be carried out only to such an extent as is absolutely necessary, with due consideration of the needs of the country, not only at the present time but also in the future, and in a manner that will interfere to the least possible extent with the responsibilities and the duties of these services. We cannot but feel that up to the present time these qualifications have not received adequate consideration at the hands of Government.

The extent and the method of application of the retrenchment to be imposed on the scientific services was referred to a small body of members of the Legislative Assembly, not one of whom, so far as we are aware, can claim to be considered a scientist or to have any first-hand knowledge of the various Surveys concerned and of the work that they have done in the past, are doing now or, what is still more important, what they could do for the development of the country in the future. One result, and a most unfortunate one, of the transfer of the Government of India from Calcutta to Delhi in 1912 has been to entail the isolation of the Government from any contact with those who have devoted their whole life and energy to the attainment of scientific knowledge and to the application of such knowledge to economic problems, for the headquarters of all the scientific Surveys, Topographical, Geological, Botanical and Zoological, are and have for many years been in Calcutta; and for some time past the Government has clearly betrayed a lack of knowledge of the work that the Surveys have done and a still greater lack of appreciation of their importance to India.

In other civilised countries a great deal of work of scientific importance, both theoretical and economic, is carried out by institutions and individuals other than those employed at Government's expense; but in India such a condition of affairs is not yet possible to the extent demanded by the needs of the country. Scientific education in this country is still in its infancy and hence the need of Government support is all the greater; in this connection one cannot but contrast the present action taken by the Government of India with that taken by the Government of Great Britain. In spite of the urgent need of retrenchment in the latter country, a need that is as great, if not greater, on financial grounds as that with which the Government of India is faced, there has been no retrenchment whatsoever in the scientific personnel employed by the Government; schemes of future expansion have for the time being been dropped but there has been no actual going back. One cannot but feel that this is largely attributable to the fact that in Great Britain there is a large body of scientific opinion with which the Government is in close touch. Indeed, attached to the Government of Great Britain and working under the Privy Council there is a Board of Industrial and Scientific Research, part of whose functions it is to keep the Government informed regarding scientific matters and to whom the Government can turn for advice on any matter of scientific importance: moreover, this Board being attached to the Privy Council, is thereby removed from any question of political, as apart from financial, advisability or necessity.

In this country the Government of India in 1921 abolished the only scientific advisory body that it possessed, namely the Board of Scientific Advice, and thus deliberately deprived itself of the only source that it possessed of obtaining the advice of a body of scientific men in its employ on scientific matters.

Some two years ago the Bombay Natural History Society was consulted by the Government of Bombay regarding the desirability of establishing a National Research Council for India; other bodies throughout India, such as the Asiatic Society of Bengal and the Indian Science Congress, were also consulted on the same matter, and they unanimously urged the Government to create such a Council, one of the functions of which would have been to advise the Government on just such problems as they have now to face. Unfortunately, nothing has as yet been done in the matter; and in consequence one cannot but feel that the Government, deprived of the benefit of the advice of any body of educated scientific opinion, has by its present proposals definitely surrendered or is in grave danger of surrendering the scientific needs of India to politics.

The question of the retrenchment of three of the scientific Surveys of the Government, namely the Geological, Botanical and Zoological Surveys, cannot be separated from the further question of the adequate maintenance of the Indian Museum, Calcutta, since the scientific staffs of the Natural History and Economic sections of the Museum are provided entirely by these Surveys.

The proper maintenance of the Indian Museum is absolutely essential to the future of India; at present it is one of her greatest educational assets. Every research worker in India, in Geology, Botany, or Zoology, would without hesitation offer his testimony to the very great help that he has received from the Museum in his work—help without which it would have been impossible for him adequately to carry on. Furthermore, the priceless collections in the

Museum, both those displayed in the Public Galleries and those contained in the Research Collections, which are open to inspection and examination by every *bona fide* research student in the country, cannot be neglected. In 1875 the Government of India, at the request of the Asiatic Society of Bengal, created a national Museum for India and made itself responsible for the proper care and maintenance of these collections; and their responsibility is far greater now than it was then, owing to the increased size of the collections and to the vast amount of research work that has been carried out on them, the result of which work has been to raise India to the scientific status that she now holds among the civilised countries of the world. By the present wholesale reduction in the scientific staff of the various Surveys, the Government of India is deliberately ignoring the onus that devolves on it in this matter, and is repudiating its responsibility for the careful maintenance of these valuable collections that do not belong to it.

As the Indianisation of the Surveys continues (a process that is even now almost complete in the Zoological Survey, since the present Director is the only European Officer), and the economic development of India progresses, as it must progress if India is to retain her position as a civilised nation, the need of fully trained Indians will be paramount; yet by their drastic reduction of their scientific personnel the Government of India are deliberately depriving this country of the officers whose knowledge will in the near future be all-important.

For some years past the Zoological Survey of India has associated itself with all the zoological work that is being carried out in India and has extended assistance and encouragement to all who are interested in the subject, and especially to the zoological departments of the various universities. With a far-sighted appreciation of the needs of these teaching institutions, the zoological Survey has recognised that unless the professors and lecturers of these universities are themselves engaged in research-work, they must of necessity rapidly deteriorate into mere exponents of text-book statements, and that it is only by his own research and by encouraging research-work by his advanced students that a professor can stimulate the enthusiasm of his students and rouse in them the desire to help to contribute in their turn a little to the sum total of our knowledge. Many of our universities and colleges are indebted to the Zoological Survey for the presentation of named specimens to their small teaching museums or for the correct identification of animals submitted to them for examination. The splendid library of the Survey has with great generosity been placed at the service of all *bona fide* research workers, and it is no exaggeration to say that without this concession zoological research work in India would be so hampered that it would be impossible to attain or to maintain such a standard as is now-a-days necessary. With a reduction in the numbers of the gazetted staff of the Survey there must, of necessity, go a serious diminution in the amount of research work published by the Survey; and this must in turn tend to jeopardise the maintenance in an up-to-date condition of the library, since this depends to a very large extent on exchanges with scientific and learned societies and institutions all over the world. The Zoological Survey at the present time exchanges publications with some 300 such bodies, and this number is steadily increasing. Only those who have had occasion to consult the library can appreciate the value of this system at its true worth; but the Government of India would very quickly realise its financial advantages if in the future it became necessary, owing to the withdrawal of their exchanges by these other institutions, to purchase their publications at the market price, instead of under the present arrangement merely having to strike off the necessary additional copies of the *Record* and *Memoirs of the Indian Museum.*

There are but few problems in Agriculture, Sanitation or Preventive Medicine that do not include some problem in Zoology, and the result to India of the contemplated retrenchments in the Zoological Survey, with the consequent deterioration of the library and the curtailment of the staff, will produce an effect in this country that may be realised if one tries to envisage what the destruction of the Natural History section of the British Museum would be to England.

That economies in the workings of the various Surveys can be effected we do not doubt. One way in which such economy could be brought about is by a greater degree of collaboration between the various departments; as an example we may cite the unnecessary delay and expense that was entailed only a year or so ago by the creation by the Agricultural Research Council of a special Locust Research Survey, when an Imperial Economic Entomologist, with a trained subordinate staff at Pusa, and a Zoological Survey of India in Calcutta were already in existence.

In conclusion, if it be not too late, we would urge the Government, before it takes any irrevocable action, to appoint a Committee of scientific men in this country to go into the whole matter and prepare a scheme of retrenchment, whereby adequate savings may be attained without involving such serious steps as the wholesale retrenchment of a scientific personnel which in the near future will be absolutely indispensable to India's progress, or the neglect of the very valuable scientific collections for whose care and preservation the Government of India made themselves responsible more than fifty years ago.

SALE OF THE ORNITHOLOGICAL COLLECTIONS AT TRING.

While the prevailing depression has had its adverse effect on Scientific work in India its effect is equally apparent in England. The famous Bird Collection at Tring is to go to America. Lord Rothschild has been compelled to sell it to an American Museum. Ornithologists throughout the Empire have learnt of his Lordship's decision with dismay. The passing of Tring is a loss not only to British Ornithology but to European Ornithology and to Ornithologists the world over. While the bird collections at Tring were in no way comparable to those at the British Museum, they formed a perfect complement to the collection in London. They contained just those specimens which the British Museum required to make its collection complete. Tring is within easy reach of London, and London is where Ornithologists must go if they are doing work of real importance. The collections in both institutions were hence readily accessible to workers. The removal of the collection to a location so difficult and expensive to reach cannot but prove a serious obstacle and Ornithologists will now solely miss the facilities they so long enjoyed. Besides a considerable part of this collection is concerned with European Ornithology. Take for example the Brehm collection with its 371 types, and it is by workers in Palaearctic Birds that the loss will be most keenly felt. They will be cut off by so many thousands of miles from this one though highly important collection which is now to be housed across the Atlantic. And though the Americans have acquired the Tring Collection they will be still compelled to visit Europe to consult the European collections if they are to do work of any real value in European Ornithology.

It was always believed that this great collection would ultimately become the property of the Nation and many of those who contributed to it were very probably influenced by the consideration that they were helping to build up a National asset. It is undoubtedly also for this reason that the British Museum refrained from entering into competition with Lord Rothschild who is one of its Trustees. There was always the most friendly rivalry, and co-operation between the Government and the private museum.

The pity of it is that the whole transaction was shrouded in secrecy. It has been pointed out, for reasons which have not been made public, that neither His Majesty's Government nor the Trustees of the British Museum were approached in the matter. There is nothing to be said about Lord Rothschild's right to dispose of his private collections and one cannot but deplore the circumstances which compelled him to take this decision, but it is difficult to discover reasons why an offer was not first made to the Nation to acquire a collection upon which it had reasonable claims before deciding on its sale to a foreign country.

REV. FATHER E. BLATTER, S.J., Ph.D., F.L.S.

Rev. Father E. Blatter, S.J., Ph.D., Vice-President of the Society, was the recipient for the year 1931 of the 'Johannes Brühl Memorial Medal.' The announcement was made at the Annual Meeting of the Asiatic Society of Bengal held on Monday 1st February 1932. The award was made in recognition of his 'Conspicuously Important contributions to the knowledge of Asiatic Botany.'

Father Blatter requires no introduction to the readers of this Journal. For more than 25 years we have continued to publish many of his important contribution on Indian Botany and we hope that we shall be privileged to do so for many years to come.

The Committee of this Society on behalf of its members takes this welcome opportunity of congratulating Father Blatter on the honour that he received for his labours in a branch of study which he has so greatly adorned and of expressing their deep appreciation of the manifold service he has rendered this Society during his long connection with it.

OBITUARY.

Mr. G. M. Ryan.

(From the *London Times 12-1-1932*).

Mr. George Michael Ryan, F.L.S., late of the Indian Forest Service, who died at his residence in Ladbroke-gardens on Friday, was widely known for the application of his scientific knowledge to the improvement and preservation of old, historic trees in these islands. He was in the Indian Forest Service from 1883 to 1914, mostly on conservancy work in the Bombay Presidency, and reached the grade of deputy conservator in 1892. His researches and practical work on the preservation of old trees won the support of the authorities of Kew, who referred to him inquirers from all parts of the country. Among the trees on which he advised was the famous old yew standing in Bookham churchyard, and the oak in Holmwood Park, Keston, under which Wilberforce sat with Pitt when he decided to bring in a Bill for the abolition of slavery in British plantations. It was described in his diary as " an old oak." Last year Mr. Ryan drew the attention of the Council for the Preservation of Rural England to the neglected condition of the Queen's Oak or Robin Hoods Oak in Sherwood Forest, and wrote that the presence of a caretaker was of little use so long as this 'historic monument' was not scientifically treated for the further preservation of its life. Mr. Ryan was a generous-hearted man with many friends.

[Mr. Ryan was an old member of this Society. During his residence in India, he contributed a number of notes to the Society's Journal mostly of Botanical interest. Among his contributions were the papers on Wild Yams as famine foods and the Water-yielding plants of the Thana Forests.—Eds.]

AN APPEAL.

(From the *London Times 12–1–1932*).

FRESHWATER EELS IN BRITISH INDIA.

For some 10 years now I have been collecting data regarding the occurrence or absence of freshwater eels—of the genus *Anguilla*—in the freshwaters of the world, and we seem on the whole to have cleared up this matter. Yet there are two regions where some uncertainty still reigns, and curiously enough, British India is one of them.

I have seen specimens of freshwater eels from the greater part of India, from Burma to Bombay, but whether they occur north of Bombay, and especially in the River Indus, I have not succeeded in determining, neither through the available literature nor through questions. Yet it would be astonishing, it seems to me, if there were no information on this subject from one of the principal river systems of the Old World.

The question is of considerable importance for the understanding of the distribution of the freshwater eels which spawn in the Indian Ocean. It would be of interest, therefore, if Indian zoologists or others concerned with the fisheries there could take notice of the question and *discover whether freshwater eels of the genus Anguilla are really present or wanting in the River Indus.*

I am, etc.,
JOHANNES SCHMIDT,
Carlsberg Laboratorium, Copenhagen,
Denmark.

REVIEWS.

THE FAUNA OF BRITISH INDIA, INCLUDING CEYLON AND BURMA. REPTILIA AND AMPHIBIA. By Malcolm A. Smith. (Vol. I. Loricata, Testudines. March, 1931: London). Published under the authority of the Secretary of State for India in Council and edited by Lieut.-Col. J. Stephenson, F.R.S.

The object of the 'Fauna of British India' series is, and should be, the advancement of knowledge concerning the animal population of the great Indian Empire. In the past the average zoologist had an eye mainly for the structural details of a long-dead specimen in a museum, but fortunately the trend of research is gradually changing and the young biologist is seeking more and more the knowledge of the living. At the request of the Editor, Dr. Smith has included in the volume under review a general account of the structural characters and habits of the group, so far as possible, and in so doing he has laid herpetologists and naturalists in general under a deep debt of gratitude. The volume in its present form is not only useful to systematists, but can be consulted by advanced students of Indian Universities, especially of the Agra University where Reptilia is taught as a special subject for the M. Sc. degree, as a text-book on the subject.

It is to be borne in mind, however, that 'In the exact distribution of species, in their individual variation, in habits, life-histories, in fact in bionomics generally, a vast amount of investigation is still to be done.' The work on the bionomics of a group of animals can generally only be accomplished by those in the field, and it is earnestly to be hoped that naturalists with a real love for the living animal will supply the deficiency as they have so admirably done in the past. Dr. Smith's work as he states, shows by its omissions how much still remains to be done in this direction.

Great pains have been taken to make the volume useful even to a beginner. A glossary of technical terms is included and a comprehensive bibliography is given. In the introduction the author explains the generally accepted rules of zoological nomenclature, and one is painfully reminded how by their strict application some of the very familiar names have to be suppressed, and practically unknown names substituted, before finality in nomenclature can be reached. The introduction also contains a history of Indian Herpetology with short biographical sketches of the prominent workers. The zoogeography of Indian Reptiles and Amphibians is treated in a fascinating manner; and suggestions are offered regarding the preservation of specimens. This introductory account is evidently meant, though nowhere so stated by the author, for all the four volumes which Dr. Smith intends to bring out in this series on Reptilia and Amphibia (Volume II will be devoted to the Lizards, Volume III to the Snakes, and Volume IV to the Amphibia).

Dr. Smith's work covers the Indian Empire and the Indo-Chinese Sub-region; the inclusion of the latter is justified by the author on zoogeographical grounds. By this arrangement the new volumes of the 'Fauna' will include a number of species not treated by Boulenger in his volume on the 'Reptilia and Batrachia.' Considering the fauna of the Indian Empire one finds that since 1890 only five new species have been added. This bears out Dr. Smith's remark that in this group of animals no great field remains for a mere collector in search of new species. In Boulenger's volume 44 species of Chelonians were described, whereas in the new volume there are only 43 from British India, in spite of the added species. This shrinkage in the number of species is due to an examination of large material, and a careful and detailed study of the types of species, whenever available. Of the 57 species treated in Dr. Smith's volume, 14 do not belong to British India.

It is a matter of considerable satisfaction that Dr. Smith's volume is comprehensive and complete in itself, whereas information in Boulenger's volume has to be amplified by reference to his Catalogues of the British Museum.

The work is beautifully illustrated, but unfortunately Dr. Smith has omitted to give the magnification of the figures in the text and in the plates, and, moreover, some of the figures are crooked in the text (fig. 38, for instance). It would have been better if in the description of figures the names of the authors of species had been repeated. A casual perusal of the volume has shown that some page references in the synonymies are inaccurate, but in a work of this magnitude such mistakes are apt to occur.

In reading this volume one feels that the author is writing from a first-hand knowledge of the mode of life of the animals he has so admirably classified for the 'Fauna.' Dr. Smith is to be congratulated on this production. Herpetologists and naturalists in general will look forward with keen interest to the remaining three volumes in the 'Fauna' series by the author of the work here reviewed.

S. L. H.

A TEXT BOOK OF ELEMENTARY ZOOLOGY by Mr. Bonavis Bonnel, M.A., xiii, 192 pp. illustrated. Second Edition, revised and enlarged, Published by Kesari Printing Works, Madras, 1930, and sold by the Christian Literature Society, Madras. Price Rs. 2.

The book, which is running its second edition, is primarily intended for the use of the students of the Intermediate classes of the Madras University, but will also be found useful not only by the Medical Students and the students of the other South Indian Universities, but also by those elsewhere in India. Since its appearance a few years back much useful information has been incorporated by the author in order to free it from its originally much more limited scope and application.

The first few chapters are devoted to general biological considerations. Then follow the life histories of some 14 types treated in detail. A commendable feature of these is that Indian types have been mostly described. This avoids divorce, at one time a very common defect of the biological teaching in India, between the types used for lecture purposes and those actually studied in the practical class. Even where the former were imported the student learnt little of their *biology* : he merely looked at the dead animal and dissected it. This incompatibility, inculcating as it did confusion of thought and ideas and slovenly habits, is happily now disappearing. The authors who like the present one are helping in this very necessary reorganisation are to be highly congratulated.

The study of the types is begun with the Frog, a most convenient type, with which to initiate a beginner into the study of Zoology. The author then takes up Protozoa (Amœba and Paramœcium), and beginning the Metazoa with Hydra and Obelia, takes the reader through Cœlenterates, Arthropoda, Mollusca, Pisces and Aves to Mammalia. In the selection of types and their arrangement although subjective considerations of the authors naturally play a large role, one asks whether after all, on the principle of 'from the known through the less known to the unknown' which is applicable with particular force to the teaching of beginners, it would not have been a better arrangement to relegate the progressively less known types (and certainly of the *microscopic* Protozoa) to later chapters.

The last chapter is devoted to 'Classification, Evolution and Heredity.' Although the treatment on the whole is less satisfactory both from the points of view of the material and presentation, Evolution and Heredity are much more satisfactorily treated than classification. The treatment of the latter is sure to leave a good deal of vagueness in the mind of the student and stands in need of much amplification and elucidation.

For the rest the language is simple and clear and the descriptions of the types methodical. The diagrams though ample in number, leave much to be desired in quality. Students, specially elementary students for whom the book is intended, require not only clear and methodical descriptions, but also well shaded, clear diagrams and realistic pictures.

There are a few printing mistakes in places.

N.K.T.

BOTANISCHE VERSUCHE OHNE APPARATE.—By Dr. Hans Molisch emer. o.o. Professor und Direktor des pflanzenphysiologischen Institutes an der Universitat Wien. xii + 200 with 62 figures. Gustav Fischer Jena, 1931.

The author of this highly engaging and instructive book is already a renowned botanist and the writer of several standard botanical treatises, both technical as well as popular. He is also a keen and widely-travelled naturalist, and, until recently, was the Professor and Director of the Plant-physiological Institute at the University in Vienna. This latest, though one hopes by no means the last, of his publications, therefore, comes to inherit all the rich and varied experience, gained through wide travelling, close observation and deep thought, on the various phenomena of plant-life. Besides these, the reader also has the benefit of his mature experience as a teacher and investigator.

The motto of the book is 'The simpler the experiment, the finer it is.' In keeping with this, most of the observations and experiments detailed in the book, and the methods employed for their elucidation, are so simple that one begins to wonder why these did not strike every one else. Indeed, in this connection the author says in the preface that he has often asked three questions of his students and colleagues :—(1) Whether it is possible to hear the footsteps of a housefly without the use of a microphone, an amplifier or other apparatus? (2) Whether it is possible to observe the Brownian movements with unaided eyes? (3) Whether one can see the sun-light or lamp-light through wood several centimeters thick? The answer to the perplexed audience, the author informs us, has always been 'No, it is not possible.' Yet the book demonstrates that not only these, but a large number of similar other apparently perplexing phenomena, *are possible.*

In regard to this prevalent lack of observation and information, the author notes, as others who have devoted thought to the question that it is the modern tendency, which suffers from too great a stress being laid on details and technique, at the sacrifice of the more general and obvious facts which are ignored, that is responsible for the undesirable state of affairs. The result is that most students of Natural Science move through woods and fields more or less blind-folded, as it were, and return from their excursions with much poorer knowledge and experience.

One of the objects in writing this book, presumably, is to counteract this growing tendency and to create a lively interest for natural phenomena in the minds of the youth. It brings together a rich harvest of facts culled carefully from all aspects of plant-life and so simply dealt with that they can be easily investigated even while moving about, since little equipment is needed beyond a needle, a blade of straw, a glass tube and a match-stick. In most cases even these can be largely dispensed with. In fact, after reading through the book one feels surprised with how little apparatus one can carry on botanical investigations. *It is indeed the claim of the author that this is the first book ever written, which demonstrates a large number of observations and experiments without the use of complex or even simple apparatus.*

In the book are dealt with all variety of subjects covering a large number of phenomena. It is divided into five sections :—(1) Anatomical and Morphological, (2) Physical, (3) Chemical, (4) Physiological and (5) Miscellaneous. Under these are treated a surprising mass of facts covering almost all aspects of plant-life, personally investigated by the author himself.

The book is written in simple German so that it is easily comprehensible by beginners and laymen. Although primarily meant for these, it would be without doubt of very great utility also to serious students of botany and to teachers, specially on excursions. Many of the experiments are new, or are not described in other text-books. Where necessary, the text is illustrated by clearly executed illustrations. Although the book has been written with particular reference to European conditions, the facts are so general and most of the plants so common, or substituted without much trouble, that it can be easily adapted to conditions in India and other countries. Besides, where difficulties arise, it will well repay the effort to tackle and solve them. In view of this it is unfortunate that such books are not yet available to readers whose knowledge is confined only to English, but one hopes that this pioneer work of the author will sooner or later be followed by similar works in that language too.

N. K. T.

MISCELLANEOUS NOTES.

I.—AGE OF ANIMALS.

In *P. Z. S.*, pt. I, 1931, there is a very interesting and illuminating article by Major S. S. Flower on " The Duration of Life in Vertebrate Animals." It, with its four predecessors, is the first complete account of the duration of life in vertebrate animals, based on actual observations over a number of years.

I very recently came across a similar attempt in an old Sanskrit work[1] whose author flourished in XIIIth century. The work purports to be a text-book of Zoology discussing various matters, both interesting and curious. The author has attempted to describe life histories of about fifty-four vertebrate animals. The method is not scientific, as we understand the term ; yet the work is valuable, both as the first—and perhaps only—attempt of its kind in the whole field of Sanskrit literature and as a collection of beliefs about animals prevalent at that time. I will try—if the Editor of our Journal allows me—to discuss some of the items in the book in a future note. For the present, I confine myself to presenting the age-data as given, without attempting to criticise. I append a list of age-figures from Major Flower for comparison.

Animals	Span of Life in Vertebrates according to	
	Hamsadeva XIII Century	Flower in *P.Z.S.* 1931
Mammals		
Monkeys	10 years	10-15 years
Tigers	16 ,,	15 ,,
Lions	20 ,,	13 ,,
Cats	5 ,,	15 ,,
Hyænas	14 ,,	12 ,,
Dogs	10 ,,	10 ,,
Wolves	10 ,,	12 ,,
Jackals	10 ,,	15 ,,
Bears	14 ,,	16 ,,
Rats	1½ ,,	2-3 ,,
Hares	1½ ,,	5 ,,
Elephants	100 ,,	50 ,,
Horses	25 ,,	30 ,,
Asses	12 ,,	20 ,,
Rhinoceroses	22 ,,	25-30 ,,
Cows	20 ,,	25-30 ,,
Buffaloes	20 ,,	25-30 ,,
Goats	10 ,,	10 ,,
Deer	9 ,,	8-10 ,,
Camels	30 ,,	30 ,,
Boars	14 ,,	16 ,,

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[1] *Mriga-Pakshi-Shastra* ; by Hamsadeva, a Jain Author of XIIIth Century Trans. P. N. Press, Kalahasti. 1927.

Animals	Span of Life in Vertebrates According to			
	Hamsadeva XIII Century		Flower in *P.Z.S.* 1931	
Birds				
Hornbills-(*Garuda*)...	10	years	25	years
Eagles	8	,,	15	,,
Hawks	10	,,		
Swans	7	,,	14	,,
Peacocks	6	,,	10	,,
Ruddy Geese	6	,,	14 (various sp. Wild Geese.)	,,
Cranes	4	,,	18	years
Crows	5	,,	6	,,
Owls	5	,,	6	,,
Kausika Birds	5	,,	—	,,
Parrots	5	,,	17	,,
Cuckoos	5	,,	7–14	,,
Pigeons	3	,,	11	,,
Blue Jays	3	,,	—	,,
Sparrows	,,	,,	—	,,
Cocks	$2\frac{1}{2}$	,,	—	,,
Karetu Birds	,,	,,	—	,,
Herons	,,	,,	19	,,
Wagtails	,,	,,	—	,,
Plava Birds	,,	,,	—	,,
5 other Birds	,,	,,	—	,,

AHMEDABAD, HARI NARAYAN G. ACHARYA,
December 30, 1931. B.A., F.Z.S.

[The periods relative to Birds are quoted by the Editors from Major S. S. Flower's series of papers on the Duration of Life in Vertebrate animals. IV Birds. (P.Z.S., 1925. pp. 1365–1422), as the paper in question was not available to the author. The figures given for the birds are in the main relative to longevity estimated from data relative to birds kept in captivity in the Zoological Gardens at Giza, Egypt. Major Flower concludes from his study of data collected from various sources that as far as present evidence goes, no species of birds has a specific *longevity* of over 30 years but that many species have a *potential* longevity of over 30 years.

It is of interest to see from a comparison of the above tables that the duration of life of various animals particularly in regard to Mammals given by the 13th century writer accords fairly well with the conclusions arrived at centuries later. It would be very interesting to read further excerpts from the book to which Mr. Acharya refers.—EDS.]

II.—TIGER KILLING SWAMP DEER OR *GOND* (*RUCERVUS DUVAUCELLI*).

On the 10th March 1932, in company with Messrs. C. McCann and G. Nogueira of the Bombay Natural History Society and others, we had the extraordinary luck to see a large tiger kill a *gond* or swamp deer just before noon in the Dhakka Chat Kadir on the Sarda River in the Philibhit District. We had gone out for the day to a spot called Pasian, due north of Allengunj Block, which is included in the Kishenpur Block of the South Kheri Forest Division. At Pasian, there is a high bank that overlooks the whole of the kadir. We arrived there just before 10 A.M., and had breakfast. After breakfast, we were sitting on the edge of the high bank watching *gond* feeding in a swamp some 300 yards north of us. About 800 yards N.-W. of us was another swamp with a sandy strip on the west side of it. On this sand three *gond* were seated, two together and one further apart. While we were watching them a tiger sprang from the high grass and the solitary *gond* was seized, just as it entered the water, while the other two dashed off, yelling. One of the two, a young stag, joined the group near us. At the same time a number of Paddy-birds which were in the neighbourhood of the small swamp also rose and flew off. This took place at 11.15 A.M. The tiger held the *gond* down for some 15 minutes, partially in the water, and then picked up his kill as a cat does a mouse, and carried it towards the high grass. At 11.30 A.M., before entering the grass he put it down and then dragged it into the grass. We saw nothing more of him till 1.5 P.M., when he came out of the grass followed presumably by his mate, a fine tigress. They sat down on the sand, rolled about and then played together, like two huge kittens. It was a magnificent sight. They were obviously very pleased with life after a good meal. Ten minutes later, they retired into the grass to rest and did not reappear again till 3.55 P.M., when they again played about on the sand and sat about for 10 minutes, then disappeared into the grass for another meal, I expect. Only the tiger drank and that a little. This appears to agree with the observations of Best and Stewart that they don't always drink in the cold weather after a meal. We left the spot at 5 P.M. without seeing them again. All this we watched through prismatic field-glasses. The *gond* that were within 300 yards of us never left the water all day and stood most of the time gazing in the direction where their pal was killed. There were six stags and three hinds. It was impossible to stalk the tigers on foot owing to the enormous height of the *khagar* grass. We had no elephant.

HARIPUR, P. O.,
KHERI, U. P.
March 10, 1932.

L. D. W. HEARSEY,
Captain,
2nd Lancers.

III.—THE PERSIAN PANTHER (*P. PARDUS SAXICOLOR*) IN BALUCHISTAN.

I am indebted to the Bombay Natural History Society for the opportunity to examine the skin of a Persian panther obtained by Lt. A. H. K. Sangster at Sambaza in Baluchistan, 4,500 ft., during April 1931.

A description of this race of panther may be found in my paper in the *Journ., Bomb. Nat. Hist. Soc.*, vol. 34 pp. 77–80, 1930, a specimen in winter coat from Pusht-i-Kuh in Southern Persia being illustrated in pl. VI. Sangster's skin, also in winter pelage, evidently resembles very closely the Persian skin in colour and length of hair, but the moult was not imminent and the hair shows no sign of matting into tufts. The ground colour is very pale buffy grey on the back and in the centres of the rosettes, but becomes paler on the flanks and passes into pure white below. The rosettes, are everywhere black, but their edges are somewhat ill-defined owing to the length and looseness of the coat, the hairs of which are about 1¾ ins. long on the back and tail, and upto 2½ ins. on the belly. The flat skin measures: head and body 3 ft. 10 ins., tail 2 ft. 6 ins., the small size indicating a female or young male.

An interesting point connected with this skin is the discovery of this race of panther in Baluchistan, which brings it into the fauna of British India. Hitherto the most eastern locality known for it was Palan Kuh, Seistan, where Col. R. L. Kennion obtained a specimen as recorded in my paper referred to above. Col. Kennion's skin is a little darker, with the coat somewhat shorter and a good deal tufted.

I should like to take this opportunity of expressing to Lt. Sangster our great indebtedness to him for generously presenting this beautiful skin to the British Museum, as soon as he heard from me that there is no skin quite like it in the national collection and that it would be an appreciated acquisition. Sportsmen, very naturally, like to keep such trophies, as a rule, to be made up into rugs. Hence it is only rarely that the skin of freshly killed leopards, tigers, bears and whatnot, come into the Museum. Too often the national collection, which is in need of such animals, has to wait until they are dusty and faded, if not moth-eaten, from exposure. One of the attributes of Lt. Sangster's specimen is its absolute freshness.

NAT. HIST. MUSEUM, R. I. POCOCK.
S. KENSINGTON.
March 15, 1932.

IV.—USE OF ARTIFICIAL LIGHT IN PANTHER SHOOTING.

I recently read a note, by Col. R. W. Burton in the *Field* or *Game and Gun* I think, on shooting panther on foot with the aid of an electric torch.

Recently, while motoring down the Dhimbam Ghat (North Coimbatore) at night, the headlights of the car showed up a panther squatting on the roadside. The panther allowed the car to get within 30 yards of it before moving across and down the bank below the road, and I quietly brought the car to the spot where it had left the road. Leaving the engine gently ticking over, I unscrewed my spotlight (an 'Auto-reelite' with about 15 feet of wire attached), and quietly approaching the edge of the road, and directing the beam downwards, immediately spotted the panther sitting up only about 3 yards off. The panther made no attempt to move while the light was on it, merely wrinkling its muzzle in a series of rapid noiseless snarls. After about a minute, I moved the light from side to side and the panther slowly made off. About 20 minutes later, when nearing the foot of the Ghat, the lights of the car showed up the eyes of what I at first took to be another panther, but on approaching close, found it to be a young tiger. Keeping the beam of the spotlight fixed on the tiger I brought the car slowly to the edge of the road abreast where the tiger was standing, quietly opened the door, unscrewed the spotlight and stepped out on the grass bordering the road. The tiger was complacently blinking in the glare of the spotlight and allowed me to approach to the limit of the spotlight wire, I was then about 15 yards from it, when it suddenly lowered its head quickly as if to get under the ray of light. I was almost as quick in lowering the beam, and raising it again as he threw his head up the next moment; but I decided however that discretion was the better part of valour: backing, I reached the car before I expected to and the slight noise caused the tiger to bound away with a "wough". I had no weapon with me at the time which I did not regret, as the experience with both the panther and the tiger was unique for me.

HONNAMETTI ESTATE,
ATTIKAN P. O. *via*
MYSORE, S. INDIA.
March 9, 1932.

R. C. MORRIS, F.Z.S.

V.—AN ALBINO CHITAL, (*AXIS AXIS*).

As it may be of interest to you I am enclosing two photographs of an albino Chital doe shot lately by an Indian gentleman in the Doon (?) it was brought to me as soon as shot in the flesh. It is snow white and only slightly coloured below the knees; the eyes and hoofs were pink; in a bright light faint spots of a silky whiteness can be seen. It has been mounted by us according to the measurements we were able to take.

DEHRA DUN.
November 20, 1931.

G. ATKINSON.

[The photos are unfortunately unsuitable for publication. Eds.].

VI.—VITALITY OF BISON MAULED BY A TIGER.

I enclose a photo of a rather remarkable bull bison shot recently here by Capt. G. Tedcastle Colquhoun, I.A.S.C. The bull, a very old solitary, was in many respects unlike any I have seen before, One horn, as will be seen, was worn down to less than half its original length, the bison had lost half his teeth and the remainder were very worn down; the grey hair of the frontal ridge extended lower than usual; round and between the eyes the colouring was a dark golden brown; while other portions of the mask—the muzzle, the cheeks, and the under part of the jaw were thickly flecked with grey hair. The bull had a quite unusually developed dewlap, which on examination was found to contain a quantity of fluid. The bone of one hind leg had been bitten through by a tiger just above the hock and was dangling uselessly, the wound being foul; the other hind leg also carried wounds from a tiger's attack, as also, the animal's neck and face. The neck and shoulder on the off side bore scars and callouses from the tiger's mauling, and portions of the bull's face had been badly ripped and here the skin was hard, hairless, and like dried leather. The spread measures 36″ (taken from the tip of the short horn), and it must have been quite 39″ originally; the girth at the base of the horns is 21″. The good horn carries 9 corrugations, while the short one bears marks of the tiger's claws and possibly teeth. From the condition of the animal's broken leg and other wounds we judged that it had been attacked two or three years previously and it is a mystery how it was able to survive the attack with a broken hind leg and terribly scarred as it had been, taking into consideration also its advanced age. The poor brute must have suffered a lot, which may possibly have accounted for the grey hairs. That it had not died from gangrene from its smashed leg is also extraordinary; on the inner side of the leg was a jagged hole through which could be seen a portion of the broken bone and this had obviously prevented the wound from healing up. The animal was very emaciated; altogether its end was merciful.

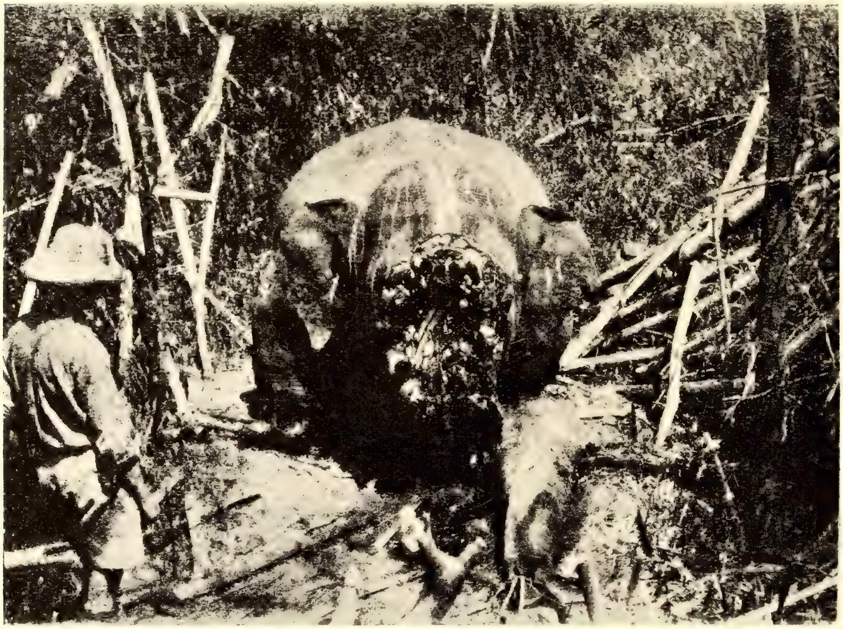
HONNAMETTI ESTATE,
ATTIKAN, P.O.,
Via MYSORE,
S. INDIA.
March 19, 1932.

R. C. MORRIS, F.Z.S.

[The photo is insufficiently clear for reproduction.—EDS.]

VII.—UNERUPTED TUSKS OF ELEPHANTS.

I write with reference to Sir Frank Colyer's excellent article on Abnormal Tusks of Elephants in the Society's *Journal* of 15th November 1930. Sir Frank Colyer, who was good enough to show me his collection of abnormal tusks in the Museum of the Royal College of Surgeons in August last year, must be regarded as an authority on the subject, but with all due deference to his opinion *re* the unerupted tusks found on the tuskless side of elephants with single tusks, I still hold that there is just a possibility that his views on the matter may not be quite correct. In his opinion, these unerupted ivories are caused and developed by a natural process of reformation on the original tusk having been torn out. This may possibly be so, but I still hold to my theory to the effect that the unerupted tusk is merely a malformed tusk, a freak of nature in fact, this abnormality being still more pronounced in 'Mucknas' which have no tusks. If 'Mucknas' were found to possess similar unerupted ivories, this would rather tend to prove my theory to be correct. After all, as 'Mucknas' exist, why should not there be single tuskers?



I enclose a photo of an elephant *minus* its face, rather a gruesome spectacle but interesting in the fact that the bony sheath on which this elephant's single tusk rested can clearly be seen, whereas there is no sign of it on the other side. If Sir Frank Colyer's contention is correct, there should surely be a similar bony sheath on the tuskless side. Sir Frank wrote to me on 26th February 1931 as follows:—'Let me see if I can make the matter clear. A growing tooth in the jaw is always surrounded by a layer of dense bone. When the tooth erupts there is still a dense layer of bone around the root. If the hard part of the tusk is torn out and the wound does not go septic then the socket fills at first with blood clot, this is replaced in time by bone, the layer of hard bone disappearing except the portion covering the soft pulp. The soft pulp is in time formed into ivory with a layer of bone around. If the tusk is split so that a portion remains in the socket, suppuration follows and the socket does not fill up and the layer of hard bone remains.'

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via MYSORE,
S. INDIA.
February 18, 1932.

R. C. MORRIS, F.Z.S.

VIII.—GAME PRESERVES AND FLASHLIGHT PHOTOGRAPHY.

I have recently been in camp with a big game photographer in an area which may later be turned into a game preserve. I cannot imagine anything more disturbing to game in a jungle than the flash and explosion of flashlights, and when a dozen cameras are placed abroad in the jungle at drinking pools, salt licks etc., the area is pretty well cleared of game in a few days. The flashlight powder is enclosed in a thin rubber bag, so forming a cartridge and intensifying the explosion.

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via MYSORE,
S. INDIA.
January 27, 1932.

R. C. MORRIS, F.Z.S.

IX.—SOME ANDAMAN BIRDS.

According to the *Fauna of British India, Birds,* second edition vol. II, I note that nothing is on record regarding the nidification of either the Andaman Shama or Osmaston's Bush Warbler. So I write to supply the deficiency.

(1) **The Andaman Shama.** *Kittacincla macroura albiventris.* This bird is common in all the densely forested portions of the larger and smaller islands of this group. They specially frequent ravines near water. They have some fine loud, clear notes, as well as some harsh ones. They are very noisy in March and April, and almost at any time of the year they will answer any one who whistles a few clear notes within ear shot. Suspecting that the birds occupied clefts or holes in trees for nesting purposes, I had a number of boxes made—8″ cubes—with a hole 3″ in diameter on one side, and fixed them against the trunks of trees about 4 or 5 feet from the ground in dense forest wherever I heard a male Shama calling. This was done early in March.

I visited the boxes periodically after this, but none were occupied until May 21st when two contained nests ready for eggs. In the next month, i.e. up to June 15, 9 of the 12 boxes I had put up had nests with eggs, mostly 3, but one 4 and two with 2 eggs only.

The nests filled the bottom of the boxes. They were invariably made of dry bamboo leaves, lined with black hair-like rhizomorph.

The eggs resemble those of the Indian Shama in colour. 12 eggs gave the following measurements :—

Maximum	...	*0·89″* × 0·68″
Minimum	...	0·80″ × *0·65″*
Average	...	0·85″ × 0·66″

Subsequently, 3 nests of similar structure were found, one in a cleft in a buttressed tree, 9′ from the ground and two others in holes in old rotten stumps, 5′ up. I reared several of the young birds from the nest and kept them loose in my garden on Chatham Island. They were perfectly tame and fearless and fed from my hand. They were very fond of small centipedes. The cocks were exceedingly pugnacious. I utilized this trait in order to catch them when required. It was only necessary to show them a small mirror when they would instantly fling themselves against the glass and could be easily caught in the hand.

They copied tunes whistled to them with great accuracy. One was specially clever at reproducing 'Way down upon the Swanee River.'

(2) **Osmaston's Bush Warbler.** *Horornis pallidipes osmastoni.*

These birds are common in dense undergrowth of high or secondary forest and are never met with in the open. They are adept skulkers and though often heard, are rarely seen.

On May 19, 1907, while pushing through dense jungle near the top of Mt. Harriet (1000′), I came on a *Horornis* calling. I began to search for a possible nest, when the parent bird began to give its alarm call *chick-chick.* This spurred me on to further endeavours and shortly I was rewarded by discovering the nest within a foot of the ground. It was a deep cup-shaped structure—*not* domed, but completely sheltered by the leaf of a ginger. The nest was supported among the stems and leafstalks of the ginger-like plant and was very difficult to locate, as nearly every ginger plant had a similar accumulation of dead leaves near the base, which resembled a nest.

While examining the nest the parent bird came within 2 feet of me, although, as a rule, it is almost impossible to get a sight of one in the jungle.

The nest was composed of dry bamboo leaves very loosely put together and was lined with fine flowering grass-heads.

The eggs, four in number, were quite fresh. They are moderately broad ovals, very glossy and of a bright chestnut colour. Mottled all over, specially at the large end with a deeper shade of chestnut.

A second nest was brought to me on 10th July, containing 4 fresh eggs of a similar colour. The second nest was lined with black rhizomorph instead of grass :—

Eight eggs gave the following measurements.

1st. nest.	Maximum	...	*0·70″* × 0·55″
	Minimum	..	0·67″ × *0·53″*
	Average	...	0·68″ × 0·54″

2nd. nest.	Maximum ...	*0·69″* × 0·54″
	Minimum ...	0·64″ × *0·53″*
	Average ...	0·66″ × 0·53″

The call of the bird is most characteristic and peculiar, of 3 or 4 notes only, loud for the size of the bird, and insistent.

116, Banbury Road,
Oxford, England.
January 10, 1932.

B. B. OSMASTON, C.I.E.

X.—NOTES ON THE BIRDS OF BALUCHISTAN.

27-8-31 to 1-9-31.—**Nutcracker.** (*Nucifraga* sp.) Takler Suleiman and Kaisar Garh range near Fort Sandeman, very common indeed in pine forest though not previously recorded in Baluchistan. Apparently the Kashmir variety, as its body is markedly more white-spotted than that of the bird with which I am very familiar in the Alps and have met on the Thibet border.

Crows. (*Corvus sp.*)—Same time and place; black crows were also common and apparently not previously recorded in Baluchistan.

Turtle Doves. Same time and place.—Several. I am uncertain which. Back vinous-red heavily marked with black. No white collar on neck that I could detect: tips of tail feathers apparently pale grey and not white.

6-7-31.—**Pheasant-tailed Jacana.** (*Hydrophasianus chirurgus*)—Khushdil Khan reservoir; only one previously recorded in Quetta district.

24-11-29.—**Red-breasted Merganser.** (*Mergus serrator*)—Khushdil Khan reservoir. Female (shot and identified)—only once previously recorded in Quetta district.

2-5-31.—**Indian Spotted Owlet.** (*Athene brama*)—on 'maidan' below Murdar.

4-12-29.—**Jackdaws.** (*Corvus monedula*)—some in a flock of rooks. Definitely no white collar. (I am familiar with '*collaris*' in Turkey.)

Choughs. Here the *Birds of Baluchistan* appears to be astray. The 'bird of the highest hills' is invariably the Yellow-billed or Alpine Chough, a bird with which I am very familiar in the Alps and in Thibet. It is exceedingly common in both winter and summer at high altitudes and I have watched hundreds of them when stalking Markhor in the spring on Khangat, Takatu, Langlum and all the high mountains of Baluchistan. The Red-billed Chough on the other hand (as in Thibet) is the bird of the high plateaux. I have only seen it once or twice in the summer (August) and then no higher than 8,000 feet. It is a regular winter visitor to the Quetta plains and valleys.

16-2-29. 10-11-29.—**Meadow Bunting** (*Emberiza cia*)—Quetta—never seen again in 3 years.

18-8-29.—**Indian Red Munia** (*Amandava amandava*)—Quetta—a small flock.

15 and 30-12-29.—**Asiatic Goldfinch.** *Carduelis caniceps*

3-4-30.—**Spanish Sparrow.** (*Passer hispaniolensis*). Quetta. The only one seen in 3 years though I was always on the look-out for it.

17-2-30. **Blackbird.** (*Turdus merula*). Quetta. The only one seen in 3 years. I think the birds recorded near Liarat must have been the Himalayan Whistling Thrush.

House Martin. (*Delichon urbica*) Definitely a common bird on all the high mountains round Quetta all through the spring and summer. I saw numbers of them when stalking and climbing on all the mountains throughout my three years in Baluchistan.

21-8-29. **Flamingos.** (*Phœnicopterus ruber*)—Khushdil Khan reservoir.

5-4-29.—**Pelicans.** (*Pelicanus sp.*)—Khushdil Khan reservoir—big flock—saw them on several other occasions.

12-2-30, 6-3-30, 19-4-31.—**Black-headed Gull.** (*Larus ridibundus*) Khushdil Khan reservoir and Quetta Valley—About 10 % were in breeding plumage (*cf.* Meinertzhagen).

15-10-30 and 16-10-31.—**Cream-coloured Courser.** (*Cursorius cursor*) two or three on each occasion near Sayid Hamid on Quetta-Chaman road.

QUETTA. E. F. NORTON,
January 4, 1932. *Col.*

[The author in submitting the above notes indicated that they were extracts from his field notes, accumulated during his stay in Quetta in 1929, 1930 and 1931. His purpose in writing them was to put down any points which differ from, or confirm doubtful points in, the paper on the Birds of Baluchistan by Dr. Ticehurst. (*Journal B.N.H.S.* vol. XXXI and XXXII.)—EDS.].

XI.—BULBULS IN CALCUTTA AND ITS SUBURBS.

Recently, public attention has been drawn in the columns of certain influential journals to the regrettable fact that some of our well-known and familiar birds are growing less and less abundant; and that some species and varieties are actually threatened with extinction in spite of the existence of protective measures. In this connection we would like to mention a class of universally-liked birds, viz. the Bulbuls. Poets have sung rapturously of the bulbuls in the past and bulbuls have not as yet lost their position as pets among the rich and poor alike. It must not be forgotten that fifty years ago a bulbul-fight was as popular a sport as a horse-race, and as enthusiastically joined in by all ranks of men from the highest to the lowest. But apart from other interests, historical or scientific, bulbuls are very agreeable birds and the decrease in their numbers cannot but detract from the charms of the country life. There are several species of bulbuls in this country and their range of distribution is very wide. We are however concerned here with those species only that are found in or about Calcutta.

The Bengal Bulbul, *Molpastes bengalensis* is known popularly as the *kala* or black bulbul. In size it approaches the English Red-backed Shrike. Although its colouring is sombre, it is considerably relieved by the delicate grey and white of the edges of many of its feathers. In suburban gardens and village shrubberies, the notes of the Bengal Bulbul imitating the sound 'hickory, dickory, dock' may be heard only in the season. They utter another cry, composed of incessant chattering, when they scent danger. Much as the black bulbul is liked for its cheerful and nonchalant ways and kept as a pet, it may be a very pugnacious bird at a moment's notice. In fact it is this fighting propensity for which the bird is prized by the lovers of the bulbul contests. The fighting bulbuls are carried about on small crutched sticks or special perches made of valuable materials, when the owner of the bird happens to be a rich man. Bulbuls are essentially lovers of quiet places, but the insatiable curiosity of the Bengal Bulbul sometimes induces it to visit towns and it is thus that pairs of these birds are seen on the road-side trees of Calcutta. The sight is however rare now. The diet of bulbuls consists mainly of buds and fruits, especially the bright scarlet fruit of the 'Telakucha' (*Cephalandra indica*) which is common in the hedges of the country-side. They are however not strict vegetarians, many bulbuls being seen to frequent the edges of ponds and watercourses in search of small insects and eggs of dragonflies. Bulbuls become very active at the end of the winter season and their nest-building operations extend from the latter half of February to the early part of June. The black bulbuls are not very particular about the choice of sites of their nests, these being found close to the ground on small shrubs as well as on the top of large trees. Nor do they care much to build in secluded places. The *Casuarina* needles, whenever available, form the most preferable building material. The nests are loosely made and display no special workmanship, except that they are reinforced with spiders' webs. The young birds newly hatched out, characterised by their rusty tinted plumage, are seen to accompany their parents for a few days. These young creatures are easily alarmed by dead leaves, twigs etc. and require some time to be accustomed to their surroundings.

The next member of the Bulbul family, in order of abundance, is the *Sipahi* or military or Red-whiskered Bulbul, known scientifically as *Otocompsa emeria.* It is a bird of more refined nature, both in appearance and habits than its black relative. Although a bit smaller in size than the Bengal Bulbul, the Red-whiskered Bulbul, so called because of the bright scarlet tufts on the sides of its head, is much the nicer-looking bird of the two, on account of its rich, brown wings, clear white under-parts and the shining, black, peaked crown. Their cheery and jubilant cries of "Did you, Did you, Do it" enliven the garden. It is a remarkable fact that while *Sipahi* bulbuls are common in the localities to the south-east of the Hoogly, they are not very numerous, and even rare in some spots, on the opposite bank. Tame and confiding by nature, *Otocompsas* love the neighbourhood of Man, coming into verandahs and porticoes and making friends with caged birds, especially of their own kind. They go about in pairs accompanied by their young, but never venture far from their nests. Unlike the black bulbul, the red-whiskered one will bestow much thought on the site of its nest, generally preferring sites hidden away among dense masses of foliage. The nests are never placed too high whether they are built on shrubs, climbers on walls or large, potted plants. The birds generally take a devious way in entering or leaving their nests, obviously with the intention of perplexing a preying enemy. The nests of the *Sipahi* bulbul are a little tidier than those of the Bengal Bulbuls. In conformity with the gay appearance of the birds, the small eggs laid by them are also attractive-looking with their pinkish ground colouring decorated by red and purple spots. Usually there are three such eggs laid at the interval of a day, of which one is often abortive. The period of incubation is about 13 days and the young birds come out in the open in a week after being hatched.

Though not included in the Bulbul family (*Pycnonotidæ*), I would like to mention the Gold-fronted Chloropsis (*C. aurifrons*). Jerdon calls it the Green Bulbul ; it is popularly known as the *haryah* Bulbul. It is not quite so common as the two former species, but this may be partly accounted for by the fact that their protective colouring effectively hides them from casual view. They fetch a comparatively high price as pet birds, and their ways are alluring although they tend to become greedy in captivity. But if they are greedy, they are certainly refined gourmands, as is evidenced by the manner of their eating. While a black or red-whiskered bulbul will break off small pieces from a ripe plantain and swallow them at once, the green bulbul will detach a large mass and keep it in its mouth, softening it by working the mandibles and gradually sucking down the juice. Green bulbuls have often been observed to congregate on kadamba trees (*Anthocephalus cadamba*) at the time of the ripening of the flower-buds. Apparently the balls of flowers are considered to be dainty dishes.

It is a matter of pity that the parks and gardens of Calcutta and its suburbs are not only now poor in bulbuls, but they are growing poorer too in bird-population generally, which, it must be conceded, is not desirable from at least the æsthetic, if not an economic, point of view.

CALCUTTA.
January 30, 1932. N. B. DUTT.

XII.—MIGRATION OF PARADISE FLY-CATCHER— (*TCHITREA PARADISI*).

In a note on the migration of the Paradise Fly-catcher, (Journ., B. N. H. S.,Vol. XXXV. p. 675.) I see that the Rev. F. S. Briggs doubts the accuracy of E. H. N. Gill's statement in regard to the United Provinces, that 'During the winter months this attractive bird occurs in most districts . . . .' If Gill includes Bareilly District in his statement, I too have reason to disagree with him. I have now been in Bareilly since the end of September 1930. I spend a considerable amount of my spare time wandering about the district but so far I have never seen a Paradise Fly-catcher here during the winter. My first record is that of an adult male seen on April 8th. I was away in May and June, but on my return in early July, I saw these birds, usually in mango topes, not infrequently in that month and August. The hot weather is again upon us, but so far none have yet appeared. In other words, in Bareilly District, the Paradise Fly-catcher appears to be with us only in the summer, arriving about April and leaving in September.

I came to Bareilly from St. Thomas' Mount, just outside Madras. In that place, I find I have no summer records at all, but many references to occurrences in the winter months, the earliest being October 7th.

I have also a few records with regard to the hills of Southern India. These are as follows:—

Mercara (Coorg).—One record only, 17th April 1924. I was in Coorg from 11th April to 16th May. F. N. Bates, however, in *Notes on the Birds of Coorg* says, 'Resident but not common.'

Kotagiri (Nilgiri Hills), which I have visited in the months of April, May, June, and July. One record only, 7th April 1925. 'A very pale-looking immature male.'

At Sigur at the foot of the Sigur ghat in the Nilgiri Hills, where I went for a week's shooting, I recorded one on 3rd January 1922. I was in the Palni Hills all April and May 1929, and saw no Paradise Fly-catcher.

As regards other parts of India, I notice I never saw the Paradise Fly-catcher at Pachmarhi in spite of being there from April 10th to well on into August, but B. B. Osmaston includes it in his list of Pachmarhi birds, remarking 'Rarely seen on the plateau. Common in the more open low valleys where they breed.'

If it is true, as appears likely, that one race at any rate winters in Southern India, and summers in Northern India, where is the dividing line?

In South Waziristan, by the way, I see that at Chagmalai, three miles from Jandola, I recorded the following: 15th February 1921, a female; 3rd May 1921, a young male; 12th May 1921, two adult males and a young male. These birds were evidently moving up into the hills.

19, CANTONMENT,
BAREILLY.
March 24, 1932.

R. S. P. BATES,
Captain.

XIII.—NESTLING OF THE INDIAN PIED KINGFISHER (*CERYLE RUDIS*) ATTACKED BY LARVÆ OF PARASITIC FLY.

On the 26th December 1931, I dug up a nest of this Pied Kingfisher which was in the east bank of the Benas River at Abu Road. The nest was about four feet deep. The entrance was a long narrow tunnel about 4″ in diameter terminated by the nest chamber. The roof of the chamber was about 10″ high at its highest point and dome-shaped. The floor was almost flat and on a level with the entrance. The base of the chamber measured about a foot across. In the nest were four fully fledged young, almost ready to leave the nest. The chamber was extraordinarily clean and showed no signs of excreta or remnants of food. However, the walls of the entrance tunnel were besmeared on either side with white marks of excreta, showing clearly that the parent birds were in the habit of cleaning the nest. When the nest chamber was reached, the young hissed very softly from time to time,—much after the fashion of a snake—this was occasionally also the case when the birds were handled during captivity. After the first day of sulking, as is so common with freshly captured birds, they ate quite freely.

A curious point arose when I first extracted these birds from their nest. One of them was attacked by the larva of a Dipterous fly, which had lodged itself in one of the nostrils. Unfortunately, when extracting it I dropped it and lost it in the loose earth. I searched the chamber to see if there were any on the floor, without success. The fly had in all probability deposited its eggs on the bird itself. This bird was marked and observed. It did not appear to me as active as the others. A couple of days later it died. On examination I could find no external cause of death. It appears to me quite possible that this bird died due to the fact that it was parasitised by the fly. However, this is an open question. I have known several cases in which the young of birds have been parasitised by flies, but up to the present I have only observed this in nests on trees and bushes which are easily accessible.

BOMBAY NATURAL HISTORY SOCIETY,
6, APOLLO STREET, BOMBAY.
January 12, 1932.

C. McCANN, F.L.S.,
Assistant Curator.

XIV.—OCCURRENCE OF THE NUKTA OR COMB DUCK (*SARKIDIORNIS MELANOTUS*) IN THE LARKANA DISTRICT, SIND.

A Nukta was shot at Drigh Dand, in the Kambar Taluka, Larkana District, Sind in November 1929. At the time, neither I nor my party knew what a *rara avis* for those parts we had secured. I am now sending you this note for purposes of record. When brought in, the men turned it over and passed it round, but the most experienced *shikaris* could make nothing of it. I know that a few Nuktas have been seen and shot in Lower Sind but I believe I am right in assuming that this is the first recorded from Upper Sind, three whole degrees of latitude north of the Badin and Sujawal District.

GOVERNMENT HOUSE,
KARACHI.
March 23, 1932.

H. T. LAMBRICK, I.C.S.

[Ticehurst in his *Birds of Sind* (Ibis. 1923, p. 443) gives a few records of Nukta shot in Sind, all of them from the southern and eastern portions of the province. Most of these were obtained in the Sujawal District. The Sindhis call it *Karo Hang* (Black Goose). There is a specimen in the Society's collection shot at Umarkot on 26th December 1917.—EDS.]

XV.—OCCURRENCE OF THE BRONZE-CAPPED OR FALCATED TEAL (*EUNETTA FALCATA*) IN KUTCH.

Yesterday my nephew shot a duck which we could see at once, was a new variety for Kutch.

We referred to two books viz. *Indian Ducks and their Allies* by Stuart Baker and *Indian Sporting Birds* by Frank Finn. There is no doubt to our mind that the bird is a Bronze-capped Teal. Still, to make quite sure, we are sending the bird to you for further identification.

Would you kindly confirm whether our identification is correct. Captain Lester's book *The Birds of Kutch* makes no mention of this duck.

It is all the more strange that in a famine year, when practically there has been no migration of duck in Kutch, such a new variety should occur.

THE PALACE, VIJAYARAJJI.
BUJ-KUTCH.
February 8, 1932.

XVI.—OCCURRENCE OF THE BRONZE-CAPPED OR FALCATED TEAL (*EUNETTA FALCATA*) IN BURMA.

I send herewith leg and wing of what I take to be the Bronze-capped or Falcated Teal *Eunetta falcata*. I have had this identified by you before from Shwebo, Xmas 1919, from Katha last year but always considered it a rarity. However this year I got 2 at Kyellagany (Katha) a fortnight ago and 3 more yesterday evening. The wing of the bird sent, being one of a bunch of 3 and my cook assures me that his dissection showed it to be a male and the other two, whose plumage was exactly alike, as females; however, his evisceration was so vigorous that I wouldn't like to swear to it. The birds looked more like small Pintail than like female Gadwall: but I had neither of these species in the bag to compare it with.

MAYMYO, C. E. MILNER.
BURMA.
January 5, 1932.

[The birds obtained by Mr. Milner and H. H. Prince Vijayarajji of Kutch were identified correctly by the respective authors of the above notes. The Bronze-capped Teal ranges through Eastern Siberia, Manchuria and Mongolia. In winter it is found throughout China, Japan and the Indo-China countries, rarely in Burma and the Shan States and even more rarely in India.—Eds.]

XVII.—OCCURRENCE OF THE GOLDEN EYE (*GLAUCIONETTA CLANGULA*) IN THE CHAMPARAN DISTRICT.

I am sending under registered cover a duck skin for identification. From description I think it may be a female Golden Eye (*Glaucionetta clangula*). Would you kindly let me know?

The bird was shot about 20 miles away from Bettiah-Rahvia jheel on 10th.

RAJGHAT,
P. O. BETTIAH
CHAMPARAN.
January 12, 1932.

A. C. HARMAN.

[The bird sent by Mr. Harman was a male in eclipse plumage which is similar to the plumage of the female. The colouring of the wings is however retained and the pure white speculum serves to distinguish the male in this phase of plumage.—EDS.].

XVIII.—OCCURRENCE OF THE SMEW (*M. ALBELLUS*) IN SIND.

A Smew was shot by H. E. the Viceroy's Party this year. It was a male and fell to Capt. M. G. D. Clive, A. D. C. at Lung, *taluka* Kambur, January 14th, 1932.

GOVERNMENT HOUSE,
KARACHI.
March 21, 1932.

H. T. LAMBRICK, I.C.S.

[The Smew is not a common bird in Sind. It has been met with on the marshes, lakes and on the Indus at Kashmor—odd flocks appear occasionally in various parts of the country.—EDS.].

XIX.—COMPARATIVE FREQUENCY OF FANTAIL, PINTAIL AND JACK SNIPE NEAR BANGALORE.

It may be of interest to place on record the proportions of Fantail, Pintail and Jack Snipe shot in the immediate neighbourhood of Bangalore and examined by me during the seasons 25th November 1928 to 14th April 1929, and September 1929 and 16th March 1930.

	1928–29	1929–30
Fantail ...	137	164
Pintail ...	204	156
Jack ...	4	7

14, FIELD COMPANY,
Q.V.O. MADRAS SAPPERS
& MINERS, MANDALAY.
February 18, 1932.

E. E. G. L. SEARIGHT,
Captain.

XX.—DISEASE AMONG CROWS.

On August 3rd 1931, I wrote a letter to the *Civil and Military Gazette* in regard to the disease which destroyed a large number of crows (*Corvus splendens*). The disease has wrought havoc among the crow population. The House Crow is a common bird round Srinagar. In winter we used to see flocks of these birds in and around the houses in Srinagar. We sadly miss them now. Not more than a few pairs are to be seen where scores used to hover about.

C. M. S. High School, SAMSAR CHAND KOUL.
Srinagar, Kashmir.
January 29, 1932.

[The disease to which the writer refers appears to have affected the crows in various parts of India last year. It was prevalent in Bombay where numbers of crows were victims to it. The birds fell from their perches and lying a while helpless on the ground, died. The cause and nature of the disease was not discovered. Tests made at the Haffkine Institute, Bombay, failed to discover the presence of bacteria of any sort. Death among crows from similar causes was also reported from Madras, Mangalore and other towns in Southern India. The mortality over the whole range of the country must have been very high—but its effect on the crow population of Bombay is imperceptible. In Kashmir, where the Sind House Crow has managed to secure a foothold, the ravages of the disease in a comparatively small colony has been presumably more noticeable.—Eds.].

XXI.—MIGRATION OF WILD-FOWL.
THE SOCIETY'S BIRD-RINGING SCHEME.

Since the publication of the last recoveries in Vol. XXXIV No. 4 of the *Journal* the following recoveries of Ringed Birds have been reported to us, the first by the Forest Technical Officer, Tomsk, Siberia and the second by Mr. V. M. Ansari, Inspector of Salt Revenue, Suigam, N. Gujerat.

Place of Ringing.	No.	Date.	Species.	Ringed by.	Date of recovery.	Locality.	Remarks.
Dhar State.	116	23-2-29	Teal ♂	Maharani of Dhar Series.	6-10-31	Near Vasugana R. Tomsk, Siberia.	
Manchar Lake ...	789	11-2-31	Shoveller ♀	R. B. MacLachlan.	5- 1-32	Suigam, N. Gujarat.	

March 15, 1932. *Editors.*

XXII.—TUCKTOO *VERSUS* DHAMAN.

(From the *Field*, 16th January 1932).

Most people who have been in Burma are acquainted with the ' Tuck Too ', a large greyish lizard with numerous pink spots dotted all over the body. A frequenter of the vicinity of bungalows, he now and then—particularly at dusk—gives vent to the little slogan from which he takes his name. At the end of each outburst he takes a deep breath which is distinctly audible, and to finish up with, qualifies his remarks with a long ' Ah ', as if of satisfaction. The number of cries given is supposed to represent his age in years. Be that as it may, the Burmese have a healthy respect for his tenacious capacity, and avow that once he gets a grip he never lets go, so they give the gentleman a wide berth. Their belief is not unfounded, as will be illustrated by the following anecdote.

A friend of mine was sitting in his bungalow one morning when a scuffle on a rafter attracted his attention. On investigation he found a ' Tuck Too ' and a rat snake in mortal combat. It appears that they approached each other along the beam in opposite directions and disputed the right of way. The snake struck out hard at his aggressor, but the redoubtable ' Tuck Too ' was on his guard and deftly ' fielded ' the snake's upper jaw in his mouth. Not to be outdone, the latter coiled himself round his opponent, and they both fell to the ground—a distance of 10 ft. The fall, however, was not sufficient to warrant a cessation of hostilities, and neither relaxed his grip to even the slightest degree.

At this stage my friend sent them along to me. I saw them about three hours later and there were no signs of surrender on either side. The ' Tuck Too ' held on doggedly with his eyes closed, whilst every now and then the snake drew a deep breath and tightened his coils. An attempt at this stage to interfere in the fight was resented, and they both let go. The snake scurried off, leaving the plucky lizard *hors de combat*. Had I not interfered I am convinced they would both have succumbed. The snake was 3 ft. 6 in. long, and his opponent 11 in. from tip of snout to tip of tail.

SHWEBO,
BURMA.

E. J. CURRAN, R.A.M.C.

[The large House Gecko (*Gecko verticillatus*), known as the Tucktoo or ' Tucktai ' because of its loud call, is a common inhabitant of houses in Bengal, Burma and the Malay countries. Though lizards form the customary food of many snakes, the tables are occasionally turned. Some of the larger lizards, like the monitors, and the present species, which is the largest of Asiatic geckos, frequently feed on snakes. In vol. xvii, p. 1017 of our *Journal*, Colonel Wall gives an account of a fight between a Tucktoo and a 4′ 6″ Dhaman (*Zamenis mucosus*). The Tucktoo was the aggressor and the Dhaman bolted into a hole leaving a portion of its tail in the lizard's mouth. In the same issue there is a note by the same author on a fight between a Tucktoo and a Golden Tree Snake (*Chrysopelea ornata*). The fight was a desperate one ; the lizard held the snake some inches behind the neck in a vice-like grip. On being thrown into the sea the combatants separated for a moment and then renewed the struggle in the water.—EDS.]

XXIII.—THE FAT-TAILED LIZARD. (*EUBLEPHARIS HARDWICKII*).

I am sending to-day per registered parcel post a specimen of a lizard found by me in the Sohelwa forests, Bahraich district, for favour of identification.

The lizard was presumably hibernating inside the loose bark of a dead *Sal* (*Shorea robusta*) tree and fell down when the bark was removed. It hardly made any attempt to run away.

I saw this same kind of lizard once before (last year) in identical circumstances but I have never seen one crawling about even in the hot weather. The lizard therefore is either extremely rare or extremely shy or nocturnal in its habits or lives on top of high trees. I purposely do not mention burrows in the ground because none have been found in cuttings made for forest roads.

I shall feel obliged if you will kindly let me know its scientific name.

You may do what you like with the specimen.

CAMP VIA SEMRA,
P. O. PACHPERWA,
DIST. GONDA, U. P.
February 16, 1932.

J. N. ONIAL,
Range Forest Officer.

[The lizard sent is an example of the Fat-tailed lizard (*Eublepharis hardwickii*); a species closely connected to the geckos from which it is distinguished externally by the possession of moveable eye-lids. Two species occur in India. *E. macularius* is found in the dry regions of the Punjab, Sind, Gujerat and the Deccan. The present species occurs in Central India, the United Provinces and Bengal. Of the two, *E. macularius* appears to be more common; it is more in evidence perhaps because of the open nature of the country which it lives in. It is entirely a ground lizard feeding on insects. A specimen lived in captivity in the Society's rooms for about 11 years. Nothing is known of the habits of *E. hardwickii*, and Mr. Onial's note is therefore of interest. It is possible that this lizard hibernates, or becomes sluggish during the cold weather. The Common Bloodsucker (*Calotes versicolor*) displays the same habit.—EDS.].

XXIV.—SOME NOTES ON WATER MONITORS IN THE GARO HILLS, ASSAM.

Water monitors are fairly common in the rivers of the Garo Hills especially in the Simsang or Someswari. Garos distinguish three varieties which they call *Aringga*, *Matphu* and *Phusil*. Speaking generally, they refer to all three as *Aringga*. Though several young monitors have been brought to me alive, I have never seen a full-grown specimen in the Garo Hills. The only difference I could see in the specimens brought me was that the markings varied *Aringgas* have very clearly defined yellow spots, while *Matphu* and *Phusil* had rather more clouded yellow markings. *Matphu* and *Phusil* are said to be dangerous animals which drag men under water and suck their blood. Garos however tell me that all three come into the fields to eat melons, cucumbers and the ears of paddy, which does not fit in well with their alleged vampirish propensities. *Aringga* according to Garo legends is a kindly beast and the friend of Man. I have heard many tales of people who are said to have been killed by water monitors but have never yet found a case which can be regarded as authentic. At Rongrenggiri, there is a deep pool in the Simsang River, said to be inhabited by these lizards and I was told a long story about a woman, who was dragged out of a boat, as she was crossing the river with a party, returning home after celebrating the Wangala feast in another village. Investigation showed that most of the party were suffering from the effects of too hearty celebrations and that the probability was that the unfortunate lady had merely fallen into the river and been drowned. During the two periods I was stationed in the Garo Hills, I have heard quite a number of similar stories in all of which, however, the case against the monitor proved to be based on the flimsiest foundations. None the less, Garos are firmly convinced that water monitors are most dangerous animals, and both fear and revere them, regarding them as not far removed from water spirits. Carved figures of *Aringgas* are to be found on the Bachelor's Houses of the Atong and Ganching Garos and the Dawa clan of Garos is descended from a man called Dawa who was a friend of the *Aringga*.

The only full-grown water monitor that I have seen was in the Kolodyne river in the Lushai Hills. It was sitting on a rock and slid off into the water as my boat approached. Lushais do not fear monitors nor have they any legends about them. This is possibly because Lushais do not build their villages on the banks of the rivers, while the Atong and Ganching Garos all live on the river banks.

The legend of Dawa and the *Aringga* is as follows:

Once upon time a young man called Dawa caught a little *Aringga* which was feeding on the melon flowers in one of the village fields. He put the little *Aringga* into a cage and gave it melons and other fruits to eat. Meanwhile the parents of the little *Aringga* came to visit their child in captivity every day. When Dawa saw these two large *Aringgas* come to his house daily, he thought that they must be the father and mother of his captive and, knowing that the home of the *Aringgas* was the river, he became very afraid lest, when he was in a boat or swimming in the river the *Aringgas* should take vengeance on him or on his people because he had captured their child. Dawa therefore decided to release the little *Aringga* but, before doing so, in order to please its parents he placed earrings in its ears and dressed it in a yellow coat. Then he made a solemn promise to the *Aringga* never to catch any Monitors, again and begged the *Aringga* on his part not to try to kill any man swimming in the water provided that he called out 'I am a son of Dawa.' After this Dawa released the little *Aringga* who became his friend and used to carry Dawa across the water on his back. Since then the *Aringga* has been the friend of man. To this day, Garos when swimming in a river or crossing a river in a boat, call out ' I am a son of Dawa ', they also never try to kill *Aringgas* and, if a Garo catches an *Aringga*, he puts rings in its ears and releases it.

Another story explains why carvings of *Aringgas* are found on Bachelor's Houses (Nokpante).

Once upon a time two young men called Aning Krang Ratcha and Chanang Gitting Pante built themselves a Bachelor's House in the Lower Regions and passed their time in it very pleasantly drinking wine, playing drums and singing about old times. One day a mortal, called Demarachi Mande Jagitang who dwelt upon the earth, heard the sounds of singing coming as it seemed from the Lower Regions and tried to find out whence the sounds were coming. When he listened carefully the sounds which at first had seemed to come from below the earth, appeared to come from the sky and when he thought the sounds were coming from the sky and consequently listened in that direction, the sounds again seemed to come from below the earth. At last a man called Katchipa succeeded in pulling aside the screen separating the earth from the Lower Regions and saw inside the earth a huge Bachelor's House from which came the sounds of singing and merriment. Katchipa persuaded the people to build a similar bachelor's house on earth and taking with him Dingara, Radinga, Rinda and Sindato went to a blacksmith who had learnt how to make *daos* and axes from Rohon Pante the blacksmith of the Lower Regions. Having obtained all the tools they required from Rohon Pante, they collected wood and bamboos and thatching grass and built a Bachelor's House. On the cross beams of this first Bachelor's House they carved figures of the *Aringga* of the Lower Regions and of Sangkni of the deep waters, a water snake. Menpa and Radinga painted these figures in colours and since then Garos have always carved figures of *Aringga* and of Sangkni on their Bachelor's Houses.

COOMBE FISHACHE HOUSE N. E. PARRY.
IPPLEPEN, S. DEVON.
December 4, 1931.

[Two species of monitor are known to occur in the area about which Mr. Parry writes, the Common Monitor, [*Varanus monitor*, (*bengalensis* of Boulenger)] and the Water Monitor (*V. salvator*). The young of both species are handsomely marked with more or less distinct ocelli arranged in bands which disappear with age; though in the Water Monitor, the yellowish markings on the belly and the lower flanks are noticeable even in adult specimens—while the adult Common Monitor is generally a drab grey. In India, the young of the Common Monitor is commonly believed to be deadly poisonous and with a few other, equally harmless lizards, is associated with the mythical ' Bis Cobra ' which is said to poison people from a distance of many feet. None of our Monitors is poisonous. Their jaws, armed with pointed teeth, can inflict a painful bite, while the muscular tail vigorously lashed out makes an effective weapon.—EDS.].

XXV.—NOTE ON THE FASCIOLATED RAT SNAKE (*ZAMENIS FASCIOLATUS*).

(*A correction.*)

I wrote a note in vol. xxxiv, No. 4, of 2nd March 1931 of the *Bom. Nat. Hist. Soc. Journal* on a specimen of the Snake, *Zamenis fasciolatus*, seen at Ahmednagar in January 1930. It was stated therein that ' Boulenger, however, mentions that *Zamenis fasiolatus* may grow to 8 ft. 5 ins.' This statement was made from some old notes I had with me. On referring to Boulenger's book in the Society's library I find this statement is incorrect. Boulenger states it grows to only 3½ ft. with a tail of 8·5 ins. So this specimen of *Zamenis fasiolatus* killed at Ahmednagar, being 4 ft. 8 ins. long, is a record one.

Bombay.
March 5, 1932.

K. G. GHARPUREY,
Lt.-Col. I.M.S.,
Civil Surgeon, Ahmednagar.

XXVI.—CANNIBALISM AMONGST COBRAS.

On the morning of February 3rd, a Cobra while in the process of swallowing another snake was killed in my compound.

I took the enclosed snap-shots before and after the partially swallowed snake was withdrawn, and much to my surprise found the partially swallowed snake to be one of the same species.

The length of the big snake was 4 ft. 9 inches.

The length of the small snake was 3 ft. 6 inches.

Trichinopoly.
February 15, 1932.

A. D. HICKIE.

[The snap-shots were insufficiently clear for reproduction.—Eds.].

XXVII.—A NOTE ON THE FISHING INDUSTRY AT DANDA.

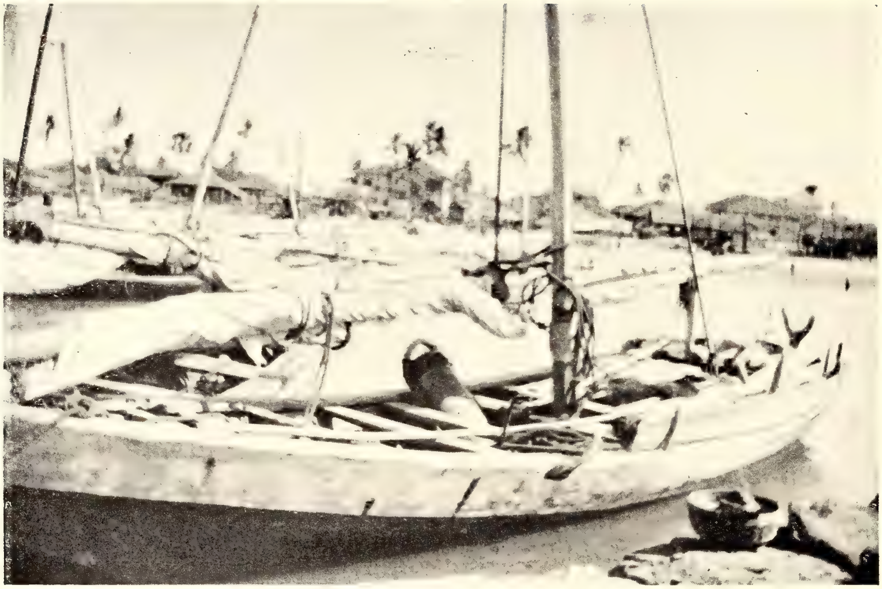
(*With a plate.*)

This village, with a population of about 400, is entirely dependent for its existence on the fishing Industry. It is fortunate in having an educated and able *Patel* in Mr. Motiram, to whom we are indebted for much information and assistance. He is himself a part-owner of a fishing boat.

There are three types of sailing craft in use at Danda, all of which are constructed in Danda by boat-building carpenters who are called in when a new boat is required.

The types of sailing craft in use, and the methods of fishing are :

1. Sailing dug-out canoes, fitted with outriggers ; costing from Rs. 150 to Rs. 300 according to size. These boats are manned by 3 men. They are not subject to the same restrictions as the larger boats, and often go out amazing distances, remaining at sea for four or five days. The method employed is to trawl, only the more valuable fish caught being kept.



One of the large boats at Danda.

One of the Danda boats about to set cut for the fishing grounds.

2. Boats costing from Rs. 400 to Rs. 600 each. These boats carry a crew of 4 men and they fish at from 5 to 7 miles distance from the shore, employing the *stake* method of fishing, described later, or more commonly the floating net moored to buoys at the ends, distended by the flow of the tide ; the net being put out at high tide, and taken in with its catch just before the next slack water. As opposed to the *stake* method the net does not reach the bottom, being only 10 to 15 feet wide.

3. Boats costing from Rs. 800 to Rs. 1,000 each, manned by 9 men. Each boat has its own fishing ground and at the beginning of the season, September or October, the ground is prepared by driving into the bed of the sea 2 stakes, i.e. very smooth laminated timber stakes, composed of carefully selected and spliced timber ; care being taken that the finished stake has no projections to foul the nets. Each stake is 60 to 70 feet long, 12 in. to 18 in. in diameter, pointed and heavily weighted at the bottom, with a grooved or slotted top and also a slot at the bottom just above the sea bed, and costs from Rs. 400 to Rs. 500. The stakes are driven or lowered into position by the fishermen from between two boats about 60 to 70 feet apart.

The usual practice, is for each boat to have four stakes. The stakes are left in position until May or June and then brought in for the monsoon. The nets used are of the purse type, the mouth of the net being attached to the stakes top and bottom, i.e., at the four corners of the net by ropes.

After this preliminary description of the boats used and methods of fishing, we will now describe an actual trip on one of the larger boats.

The following is an account of a trip with the fishermen in one of the larger boats :—

On the 3rd of February we went for a trip with the fishermen of Danda in one of their flat-bottom boats of the larger variety, with a crew of nine men. We set out at 9 a.m. with a mild wind behind us and reached our destination, some 12 miles out at 1 p.m.

The tide was on its way out so we waited till 5–30 p.m. when the two nets carried were cast and attached to the stakes. At 11 p.m. the nets were dragged up and we set sail for the village, reaching it at 9 a.m.

As soon as the boats set out, the men ate their food and settled down to sleep until the spot where the stakes are placed was reached. When the boat was fastened to one of the stakes, the sail was lowered, the mast was laid alongside it on two Y-shaped pieces of wood, and the men proceeded to mend their nets till 5-30 p.m. when it was time to cast them. Each net is tied between two stakes, and just at low or high water it is lowered into position (as the tide runs in or out it drags the net in the direction in which it is going). This done, the boat is placed directly over the net.

The men then ate their dinner and slept till 11 p.m., when they drew in the net, roughly sorted the fish, repeated the performance of casting their nets, extracted the fish from the opening at the purse end, which is normally tied up when fishing, and went to sleep till 4 a.m. Then, awaking, they dragged in the net and headed in the direction of the village.

Immediately the boat arrived, the womenfolk came alongside in small *Dinghies* and took the fish away in baskets.

The catch consisted of 7 Goals (*Sciæna*) (large fish), about 1 dozen Pomfrets (*Stromateus cinereus*), 1 dozen Halwas (*Stromateus niger*), 100 Waghtis (*Chirocentrus dorab*) and 10 Baskets of fish of various kinds.

In the estimation of the head fisherman, the value of this catch was about 40 to 45 rupees, which was the average price realised for a catch.

After the fish were taken away, the fisherman proceeded to dry their nets, as, if this is not done, they rot due to the corrosive action of the water; this is one of the reasons why they do not remain out at sea for longer periods than 24 hours.

The smaller fish are cured at the village.

When we first arrived, we were impressed at the amount of fish being dried, and at first it was thought this was for commercial purposes, but later we learned that this was done in order to provide food for the families during the Monsoon months.

On an average there are about six owners to each of the larger boats, some of whom fish themselves; others hire a crew. The boats are not insured as, even if they capsize or get swamped, they float.

Bombay.
February 16, 1932.

GORDON L. CAMERON,
C. L. CURZAI.

XXVIII.—THE GIANT LOCUST (*SAGA EPHIPPIGERA*).

There is not a great deal known by people of Iraq about this Giant Locust.

In Iraq they are usually found as solitaries; even hatchings from one egg-pocket do not keep together during the hopper stage.

The Inspector General of Agriculture has furnished me with the following note which may be of interest to you:

'Its life history so far as we know it, is as follows :—

Eggs hatch in early April. The larvæ go through an undetermined number of moults, and finally become adult wingless locusts about mid-May. They are omnivorous during their larval and adult life, but seem to prefer the hoppers or the adult Moroccan locust as food.

Egg capsules are nearly always found near breeding grounds of the Moroccan locust, and are always single pods inserted into the ground by the side of a stem of " Shok " or some other plant.

The immature hoppers show no tendency to swarm, but split up as soon as hatched.

Egg-laying occurs about June and after this the adults appear to die off, and no further specimens are seen until the following April when the eggs hatch again.

From the fact that this locust is confined to those areas in which the Moroccan Locust appears annually, and from the fact that egg-pods are usually found on breeding grounds of that same locust, I incline to the view that the *Saga* in this country may be considered as a parasite of the Moroccan Locust.'

Office of the Director of Railways, Bagdad.
January 9, 1932.

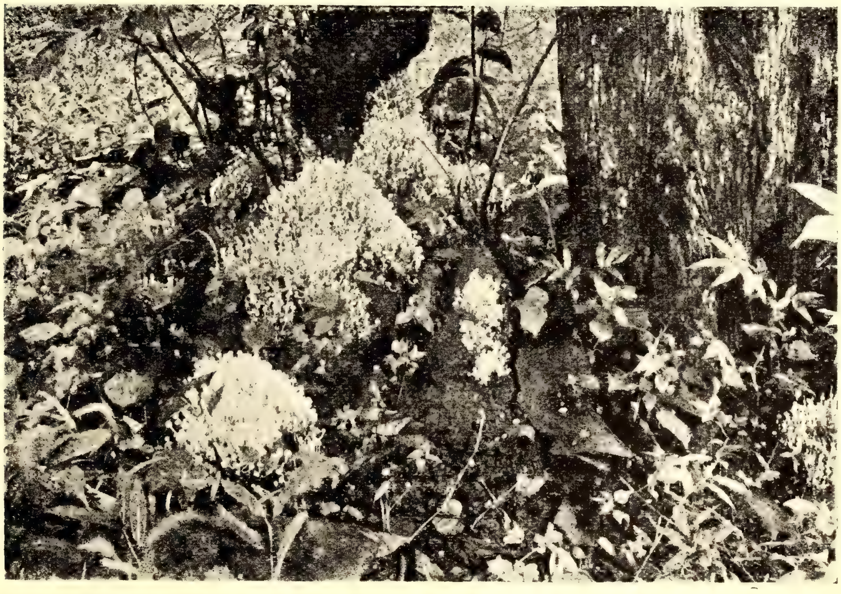
J. RAMSAY TAINISH,
Lt.-Col., Director of Railways, Iraq.

[Lt.-Col. J. R. Tainish recently presented the Society with a specimen of this Giant Long-horned Grasshopper, and the above note is in response to our enquiry for further information about this remarkable looking insect. On dissection the insect proved to be laden with eggs.---Eds.].

XXIX.—TERMITE FUNGI.

(*With a photograph*).

It is a well-established fact that termites are in the habit of growing fungi in specially prepared 'Fungus Gardens' but it is an open question as to whether the termites at any time allow or encourage the fungi to spore. As far as is known, the fungi grown in termite nests are never allowed to fructify within the nest. If this state of affairs was to continue year in and year out, it appears to me that there would be a likelihood of the particular species of fungus being exterminated in the course of time. The question is, *Do the termites do anything to avoid this?* A vital question intimately connected with their very existence.



Some years ago when collecting fungi for Professor S. R. Bose, of the Carmichael Medical College, Calcutta, I came across a termite mound covered with a small fungus as is shown in the accompanying photograph. Every portion of the outside of the mound, even isolated cones, were covered with it. On examination of the mounds, it appeared to me as though the termites themselves were responsible for this luxuriant growth of fungi. The bed on which the fungi grew was to all appearances composed of the same material of which their fungus gardens were constructed. This layer of material was super-imposed over the reddish earth of which the mounds were made. This is the first instance of this nature I have seen in all the many years I have roamed the jungles of Salsette Island.

The termite mound in question was at the time of this discovery inhabited. On digging up part of the mound I found there were still a few 'Fungus Gardens' within the nest, but it was hard to say, with certainty, whether some of the large cavities were formerly occupied by 'Fungus Gardens', and had now been emptied of their contents. This observation was made during the monsoon. The next year I visited the same mound at about the corresponding time. There was not a trace of fungi to be seen. The nest was still inhabited and only the bare earth formed the outside of the mounds. Since that time I kept an eye open for such instances but have not come across anything of the kind. Now the question arises as to whether the termites collect the spores and take them inside the nest once more along with the humus on which the fungi grew? This of course is an open question. The fungi grew so thickly on the mounds that I have no doubt that the humus below them must have been very abundantly covered with the spores, as the wind could not have blown the lot away during this season, and in such a spot. It is hard to believe that the termites did this deliberately with a view to replenishing their 'Fungus Gardens' but this casting of the old 'garden' material may have been brought about by the fact that it was of no further use, being unfertile, and was cast in consequence. Probably the mould contained sufficient fungus material to enable it to fructify, after which it was once more of great value to the termites. The termites finding this to be the case later on, probably transported it back to the interior of the nest once more. To credit the termites with such forethought would be out of the question and this end was in all probability achieved accidentally. In the first place the material was put on the outside of the nest in order to consolidate it as is the wont of termites during the hours of darkness, with earth from the interior, then later on finding that the outside of the nest was covered with vegetable material, which is valuable to them took it within once more. It is also a well-established fact that termites keep the outside of the mounds clean and finding that the outside of the mounds was covered with valuable food material, took the fungi back into the nest.

BOMBAY NATURAL HISTORY SOCIETY,
6, APOLLO STREET, BOMBAY.
January 14, 1932.

C. MC CANN, F.L.S.
Assistant Curator.

XXX.—NOTE ON *ZESIUS CHRYSOMALLUS* HUB.

Larva and Pupa.—In my note on this butterfly in my list of 'The Butterflies of Coorg,' I made the dogmatic statement that this insect has its larval and pupal stages in the nests of yellow tree-ants. On further investigation I find that this statement requires modification. Here I must express my indebtedness to Capt. N. D. Riley of the British Museum and to Mr. G. M. Henry, Entomologist of the Colombo Museum.

I based my statement on information given me concerning the habits of the insect in Ceylon. Capt. Riley, however referred, me to Ormiston, *Butterflies of Ceylon* p. 69, and to Bell, *Journal*, *Bombay Nat. Hist. Soc.*, xxvi, No. 2, p. 456. 1919. I quote the references :

1. 'I have found the pupa on the stem of an *Albizzia moluccana*. The larvæ are always attended by the large red ant, and the perfect insect may be looked for wherever these ants abound.' (Ormiston).

2. 'Eggs never laid on any tree that has not got red ants on it. Larva is constantly wandering about from leaf to leaf, and is extremely restless, a cannibal in its habits, as it will eat any of its kind that may be changing its skin or pupating. Pupation takes place on leaves. The caterpillars make leaf-cells or houses like those of the genus *Arhopala*.' (Bell).

I then wrote to Mr. G. M. Henry, who, I had been told, had obtained perfect specimens by taking the pupæ from the nests of the red (or yellow, as I called it) ant. He very kindly gave me the following information :

'The caterpillar, in Ceylon, feeds on the young leaves of various trees, notably the cadju-nut (*Anacardium occidentale*) and is always attended by red ants (*Œcophylla smaragdina*), but it does not necessarily live in the nests of the ant—although I am inclined to think that it returns to these when not feeding, etc. It does, however, almost invariably, I believe, take refuge inside the ants' nests for pupation, and it was by searching these that I was able to obtain pupæ and so rear perfect specimens.'

'The nests of *Œcophylla* are generally made among mature leaves, which do not suit the larva of *Zesius*, and so I am doubtful whether it customarily feeds inside the nests : but it certainly has no fear of the ants and enters their nests with impunity.'

From these quotations the following facts and questions emerge :—

1. The larva is attended by red ants, among which it lives. Whether it is looked after by the ants for the sake of a secretion in honey glands, has to be investigated in the field. Also, is it to be found in the nests ?

2. Are the Indian ants the same as the Ceylon *Œcophylla smaragdina ?* or do other species protect the larva of *Zesius* ? The nests are made among the mature leaves—I am doubtful however if, round Bangalore, only mature leaves are used—of various trees and shrubs, *Albizzia moluccana*, *Anacardium occidentale*, *Eugenia jambolana*, mango, matti (*Terminalia tomentosa*) etc.

3. The pupa has been found on the stem of *Albizzia moluccana*, in leaf houses similar to those of *Arhopala* (*amblypodia*), and in

Ceylon, almost invariably, inside the nests of the red ants. It would appear to have no uniform place of pupation.

Seasonal variations.—I regularly visited one patch of jungle reserved for sandal, in the Koramangala Reserve Forest, 28 miles from Bangalore, for the sake of this insect. It was rare or did not occur in many other patches of jungle that I visited, but in this patch, consisting mostly of low and bushy growth, with few scattered trees, it was to be had, quite plentifully in some months, throughout the year. From an examination of a large number of specimens, there emerged the fact that I have not seen noticed in books, that there are very definite wet and dry season forms, with intermediate forms, and very great individual variation, especially in the colouring and distribution of the bands and red spots below.

1. *Dry season form.* Approximately from January to early May. The extreme D. S. F. occurs in the latter end of March and in April, i.e., the driest period.

♂ Light coppery red : the violet gloss (*vide* Evans) scarcely visible ; the fuscous border narrower than in W.S.F. Below much paler grey than in W.S.F., spots very variable ; faint, often little or no red visible, or red spots only at base *fw* and *hw*.

♀ Above pale chalky blue ; borders brown. Below very variable ; spots and viscal bands faint, often only just visible on whitish or chalky ground. Red spots as on ♂ either not apparent or only at base. Often not more than one spot reddish.

2. *Wet season form.* Approximately June to December. Transitional forms in May and November-December. But there is no fixity about the changes, and the gradation from wet to dry and from dry to wet goes on throughout the year. Darkest above and below from about July to September.

♂ above deep coppery red ; violet gloss distinct. Fuscous border broader, especially at apex, than in D.S.F. Below, deeper grey ground, in darkest forms with a reddish tinge. Markings all distinct with dark enclosing edges. Red in spots variable ; in some cases up to discal band ; most distinct at base and across cell, but in some cases limited to base of cell *fw* and *hw*.

♀ Blue *upf* and *uph* much deeper than in D.S.F. almost electric blue. Below not so dark as ♂ as a rule or without the reddish tinge but deeper grey than in D.S.F., with markings up to sub-marginal band all clearly defined. Sometimes as in ♂ red or reddish up to discal bands. Sometimes red completely absent or present only in spot at base.

Miscellaneous.

1. ♂♂ have only two tails. ♀♀ have three, one very short tail above tornal spots, with two longer tails below.

2. One form of ♀ has no blue above or only a faint trace of blue on dark brown near base. This form I took in wet forest in Coorg, and I notice that similar specimens in the British Museum come from near Karwar, W. Kanara. Is this form a wet area form ? In the drier jungles of the Mysore plateau, I saw no ♀♀ approaching this form.

3. ♂♂ are often quasi-gregarious in their flight. Half-a-dozen or more will fly about one bush or branch, chasing each other. ♀♀

seem to go about their business singly, and more sporadically on bushes through the jungle.

BERKHAMSTED
HERTS, ENGLAND.
February 2, 1932.

J. A. YATES.

[Since writing the above, Mr. Henry has kindly written to me ;— ' Your query whether the caterpillar is " looked after by the ants for the sake of a glandular secretion " may be answered in the affirmative, as the ants may constantly be seen crawling on and about these caterpillars and licking a dorsal gland.' J.A.Y.].

XXXI. 'BUTTERFLIES OF LAHORE.'

I have been favoured with an advance copy of Brigadier W. H. Evans's Note on my paper on the 'Butterflies of Lahore' (Bulletin of the Department of Zoology, Punjab University, Vol. I, pp. 1–61, pl. I-IV, April, 1931). The note itself has since appeared in the Journal of the Bombay Natural History Society (Vol. XXXV, No. 3, p. 667, 15th Feb. 1932). I have re-examined my specimens in the light of his criticism, but can only confirm the names already given in the paper.

Comparatively little work has been done on the butterflies of the Punjab plains, and it should not, therefore, be surprising if some forms of which there is no previous record from this region are subsequently discovered.

Many species of butterflies are known to occur on the hills as well as on the plains, whilst others are even cosmopolitan in distribution. That *Aporia soracte* and *Ypthima nareda* are 'Himalayan insects not occurring below 5,000 feet' only means that the two species have not previously been recorded from the plains, but does not necessarily preclude their occurrence at lower altitudes. As a matter of fact the latter species has already been recorded by F. Hannyngton to be 'Common at 2,000–7,000 feet' in the vicinity of Naini Tal (Jour. Bombay Nat. Hist. Soc., 1910, p. 136). Recent investigations in America by means of aeroplanes show that an insect may be found as high as 14,000 feet from its place of abode. Thus the cotton leaf-worm moth (*Albama argillacea, Hb.*) usually occurs upto 3,000 feet, and the cotton flea-hopper (*Psallus seriatus Rent.*) upto 5,000 feet. Such insects as leaf-hoppers occur upto 7,000 feet, and minute parasitic flies, Aphids, etc., upto 14,000 feet (Year-book, U.S.A., Department of Agriculture, 1931, pp. 320–323). A more intensive work would probably show that there are several more species of butterflies so far recorded only from the hills, which occur also on the plains. *Argynnis aglaia*, which Brigadier Evans regards as 'A European butterfly which only reaches the Indian Empire in Chitral and the countries nearby, flying at over 6,000 feet', is now known to be comparable in distribution to species like *Melitaea didyma*, a European butterfly, which has actually been recorded from Chitral and the Punjab (Antram, 'Butterflies of India', 1924, p. 201). Nor is the occurrence of *Araschnia levana* in India unparalleled, since a single specimen of *Argynnis maia*, a European species, has been recorded from probably near Gilgit (Bingham, Fauna of British India, Butterflies, Vol. I, 1905, p. 435). It may also be noted that I have obtained in Lahore only one specimen of each of the four species, which according to Brigadier Evans do not occur in that locality.

G. W. V. de Rhe-Philipe's paper on 'Butterflies of Lahore' was published twelve years ago, and since then *Mycalesis perseus*, *Terias venata*, *Catachrysops cnejus* and *Aphnaeus ictis* have actually made their appearance in Lahore, as was indeed predicted by that author. In addition to these I have obtained specimens of several other species hitherto unknown in that locality. Further, species which de Rhe-Philipe regarded as rare in Lahore, viz., *Delias eucharis* and *Euthalia garuda* (of each of which only one specimen was obtained by him) are now found to be common.

Under each species the more important references are given so as to aid others, particularly beginners, who may undertake a serious study of the butterflies of Lahore.

So far as I know, the cases of mimicry and protective colouration mentioned in my paper have not been previously recorded.

The four coloured plates at the end of the paper should be helpful to young collectors in identifying butterflies whose colouration has great specific value.

The specimens that I have collected from Lahore and described in my paper are kept in the Museum of the Department of Zoology, Government College, Lahore, and are available for examination by any serious worker.

GOVERNMENT COLLEGE, LAHORE. D. R. PURI.
March 19th, 1932.

Brigadier W. H. Evans has written the following comment on Mr. Puri's note.

I have read Mr. D. N. Puri's Note dated the 19th March 1932 and regret that I cannot modify my previous remarks, except to the extent of admitting that an insect like *Ypthima nareda* might be found occasionally as low as 2,000 feet in the Himalayas, but it certainly is *not* a butterfly of the plains of the Punjab.

As I have left India for good I shall be unable to visit Lahore to see Mr. Puri's collection, but I do not think that an inspection is needed. It is always possible for a butterfly to be imported and released anywhere, but, barring this eventuality, I can assert definitely that *Aporia soracte*, *Ypthina nareda*, *Argynnis aglaia* and *Araschnia levana* can no more be found in the wild state in Lahore than the Kangaroo or the polar bear. Incidentally there is the question of the foodplants: if Mr. Puri will look these up, he will find that they do not occur in Lahore and a butterfly cannot exist away from its foodplant.

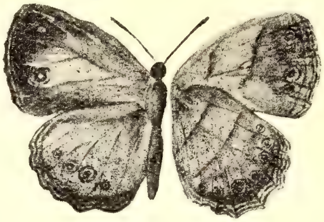
Mr. Antram's record of *Melitaea didyma* from the Punjab is certainly incorrect: the butterfly concerned is *Melitaea trivia*.

The species quoted as having, 'made their appearance' in Lahore or which are 'now found to be common' have doubtless existed there for centuries under much the same conditions. Butterflies are sometimes common one year and not to be seen in other years or they may be common in one small locality and absent elsewhere. The fact that Mr. Rhe-Philipe missed certain species or found them rare is not a matter for surprise nor an indication of their subsequent introduction.

XXXII.—*MYCALESIS ANAPITA*, MOORE.

(*With a text figure*).

A ♂ and ♀ taken in the Tavoy District, Burma, by Mr. W. L. Palmer and presented to me. This species has hitherto not been recorded within Indian limits, though it occurs in Siam ; Malay Peninsular ; Borneo ; Sumatra ; Banga and Billiton. The ♂, on upperside, is bright fulvous, heavily shaded with black on margins of forewings. The ♀ is much duller, as the fulvous portions are covered with fuscous scales. Underside dull fulvous ; the two discal fasciæ and sub-marginal bands, dull rufous. The figure is by Miss Beryl Moses, of Dehra Dun. The ♂ was identified for me by Brigadier W. H. Evans, C.I.E., D.S.O.



Mycalesis anapita (Moore) ♂.

DEHRA DUN, U. P. O. C. OLLENBACH,
February 6, 1932. F. E. S.

XXXIII.—A *PLANTAGO* NEW TO THE BOMBAY PRESIDENCY.

During a certain investigation of adulteration of seed in 1924, Mr. G. B. Patwardhan of the Poona College of Agriculture found a *Plantago* in the Cumin crop (*Cuminum cymium* Linn). The plant was sent to me for identification. It turned out to be *Plantago exigua* Murr. As Cooke does not mention it in his *Flora of Bombay*, I append its synonymy and description.

Plantago exigua Murr. Comn. Gott. (1778) 94, t. 5.—*P. pumila* Linn. f. Suppl. 131 ; Boiss. Fl. Or. iv, 891.—*P. rosetana* Poir. Dist. Suppl. iv, 433.

A small annual glabrous herb. Stems slender from a decumbent base, erect, flexuose, branched. Leaves subulate-capillary, elongate, somewhat revolute, often hirsute at the base. Spikes ovoid or subglobose, few-flowered, minutely puberulous. Bracts from a large base, subulate, the lower ones as long as the spike, the upper ones longer than the calyx. Calyx-lobes oblong-lanceolate, slightly obtuse. Corolla-lobes ovate-lanceolate, acute.

Hook. f. (in Fl. Brit. Ind. II, 708) thinks this is a form of *P. psyllium* Linn. or of *P. stricta* Shousb. *P. psyllium*, however, can be distinguished by the linear-lanceolate to linear leaves and by the acuminate, calyx-lobes ; *P. stricta* by the leaves being linear to lanceolate, and by the lanceolate to lanceolate-linear bracts. In addition, the plant is minutely pruinose above and papillose hairy at the joints.

P. exigua is indigenous in Afghanistan and Egypt. If it is mentioned for N.-W. India this is due to the fact that Royle raised the plant from seed bought in the bazaar.

PANCHGANI. E. BLATTER, S.J., PH.D.
March 2, 1932.

XXXIV.—*PUCCINIA HELIANTHI* SCHWR. SYD. A RUST FUNGUS ON THE SUN FLOWER. (*HELIANTHUS ANNUUS*)

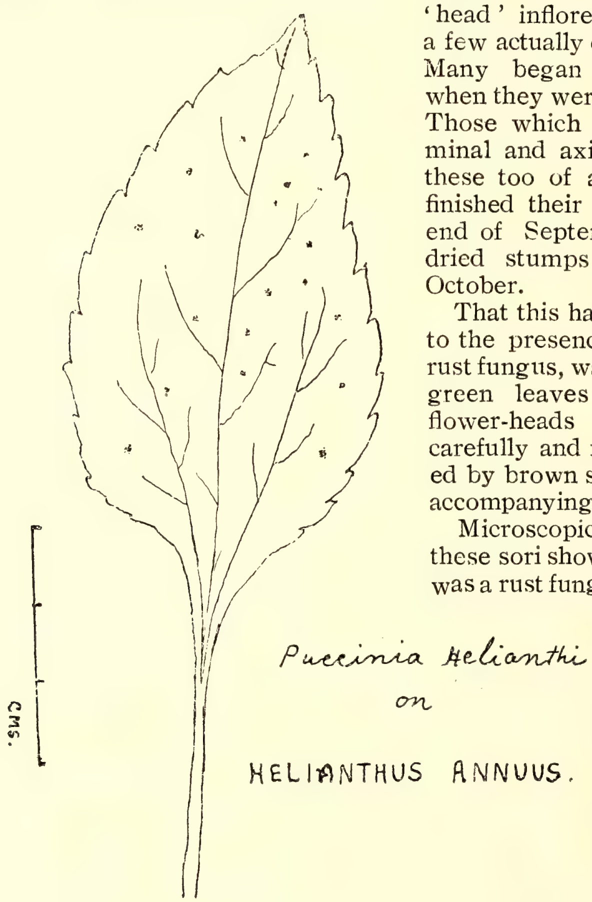
(*With a diagram*).

A few Sun flower (*Helianthus annuus*) seeds were sown in the College garden in June 1931. By August, the plants were about three to four feet in height. With this rate of growth it was expected that in about two more months' time these would be about five to six feet in height, the stem terminating in a large 'head' inflorescence. But only a few actually exceeded four feet. Many began to wilt and dry when they were hardly three feet. Those which produced the terminal and axilary 'heads' and these too of a very small size, finished their life-history by the end of September and became dried stumps by the end of October.

That this had occurred owing to the presence of a disease—a rust fungus, was clear when a few green leaves and the young flower-heads were examined carefully and found to be covered by brown sori, as seen in the accompanying figure.[1]

Microscopic examination of these sori showed that the disease was a rust fungus in its uredo and teleuto stages.

On an inquiry with the Imperial Mycologist, Pusa[2] it is learnt that the rust is *Puccinia Helianthi* Schwr. Syd., previously reported to occur on *Helianthus licaberimmus*.[3]



Puccinia Helianthi on

HELIANTHUS ANNUUS.

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[1] The dots on the leaf represent the sori.

[2] I am thankful to the Imperial Mycologist, Pusa, for the help he gave to me. S. A. P.

[3] Ref. Sydow ; Monographia Urediniarum, vol. i., p. 92.

It can be said, therefore, that *Puccinia Helianthi* Schwr. Syd., occurs on *Helianthus annuus* as well, and that it probably results in considerable damage to the host.

BIOLOGY DEPARTMENT
RAJARAM COLLEGE,
KOLHAPUR CITY.
March 2, 1932.

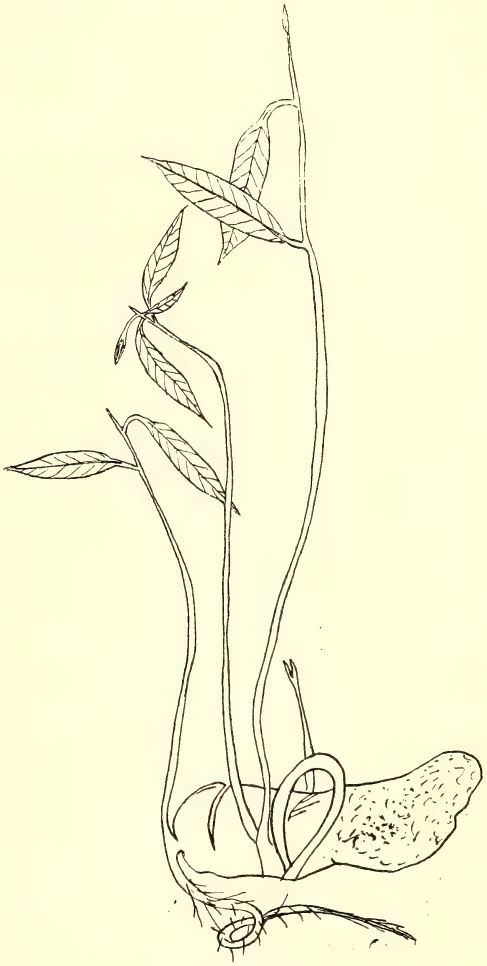
S. A. PARANDEKAR, M.SC.

XXXV.—COTYLEDONARY VEGETATIVE REPRODUCTION IN MANGO (*MANGIFERA INDICA* LINN.)

(*With a diagram.*)

The germinating embryo was collected from the Royal Lakes, Rangoon. It was growing in a shady place. The endocarp was ruptured and part of the cotyledons projected out. The whole measured 75·0 mm. and the projected portion was 35·0 mm. Four embryonic shoots were given off from the part just near the endocarp and one from the extreme part of the cotyledons. The tip shoot had its own roots system while the others did not have any separate systems.

Such a method of cotyledonary vegetative reproduction in *Mangifera indica* Linn. does not appear to be very rare, as a few others were collected from other localities, but the number of embryonic shoots was different—the described one had the maximum number.



UNIVERSITY COLLEGE,
RANGOON.
December 17, 1931.

L. P. KHANNA, M.SC., F.L.S.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY FOR THE YEAR ENDING 31ST DECEMBER 1931.

ADMINISTRATION.

President.—H. E. Maj.-General The Right Hon'ble Sir Frederick Sykes, P.C., G.C.I.E, G.B.E., K.C.B., C.M.G.

Vice-Presidents.—H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E., Rev. E. Blatter, S.J., Ph.D., F.L.S., Mr. R. D. Bell, C.S.I., C.I.E., I.C.S.

Executive Committee.—Right Rev. R. D. Acland, Bishop of Bombay, Mr. H. D. Ash, Rev. Fr. J. F. Caius, S.J., Col. Sir Frank Connor, KT., D.S.O., F.R.C.S., I.M.S., Mr. Alwyn Ezra, F.R.G.S., F.Z.S., Mr. J. B. Greaves, Prof. V. N. Hate, B.SC., Mr. J. G. Ridland, Major S. S. Sokhey, I.M.S., Lt.-Col. J. Taylor, I.M.S., Mr. A. Forrington (*Honorary Treasurer*), Mr. P. M. D. Sanderson, F.Z.S., and Sir Reginald Spence, KT., M.L.C., F.Z.S. (*Joint Honorary Secretaries*), Bombay.

Advisory Committee.—Dr. C. F. C. Beeson, D.SC. M.A., I.F.S., Dehra Dun. Mr. T. R. Bell, C.I.E., I.F S. (Retd.), Karwar. Mr. C. H. Donald, F.Z.S., Dharmsala. Lt.-Col. F. C. Fraser, I.M.S., Coimbatore. Dr. F. H. Gravely, D.SC., Madras. Mr. S. F. Hopwood, I.F.S., Rangoon. Mr. C. M. Inglis. M.B.O.U., F.Z.S., Darjeeling. Mr. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore. Major E. G. Phythian Adams, F.Z.S., Mysore. Dr. Baini Prashad, D.SC., Calcutta. Lt.-Col. C. H. Stockley, O.B.E., D.S.O., M.C., Meerut. Major W. B. Trevenen, Jubbulpore.

Staff.—S. H. Prater, M.L.C., C.M.Z.S., (*Curator*). C. McCann, F.L.S., and V. S. La Personne, M.B.O.U. (*Assistant Curators*).

HONORARY SECRETARY'S REPORT.

The Society's Journal.—The Thirty-Fourth Volume of the Journal was completed during the year under review and 2 parts of Volume XXXV were issued.

Scientific papers.—Among the important papers on Mammals was Mr. R. I. Pocock's ' Study of the Pig-tailed Macaques (*Macaca nemestrina*) ' in which the author revises the synonomy of the species and defines the races which he considers distinguishable. In another paper on the ' Scientific Results of the Vernay Eastern Ghats Expedition (Mammals) ', Mr. Pocock deals with the Bonnet Monkeys. Examination of the material collected during this Survey and its comparison with material previously collected has brought to light some new facts which necessitate a revision of the species occurring in Southern India. The southern and eastern races of Grey Langurs are also dealt with in this Report. When the author published his Monographic Revision of the Indian Langurs in Volume XXXII of the Society's Journal there were no specimens from the south-eastern areas of the Peninsula to compare with the large range of specimens obtained by the Mammal Survey in the central, western and southern districts of India. The material obtained in the Eastern Ghats is therefore of exceptional interest. It has brought to light new local races and shown that some of the forms hitherto nominally recognised were based on characters not deserving that recognition. Two distinct local types of Grey Langurs are now recognised from South India—a pale-limbed form (*P. entellus pallipes*) from the Coromandel Coast and a darker Ceylon race (*P. e thersites*) which occurs in Travancore. Examples of Grey Langurs from the Nilgiri Hills are still required to decide to which of the two forms the Grey Langurs of this hill range belong. Members of the Society residing in this area could help in deciding this point. The Monkeys collected during the Eastern Ghats Survey also provided material for the study of the Long-tailed Macaques (*M. radiata* and *sinica*) of South India and Ceylon. In a further paper on this subject, which also was published during the year, Mr. Pocock describes a new race from Travancore and gives the distinctive characters of the different species of Long-tailed Macaques from South India and Ceylon.

The late Mr. T. B. Fry contributed a paper on the proposed classifications of the Smaller Indian Field Mice. The author was able to study a very considerable range of specimens obtained by the Mammal Survey from different parts of India, Burma and Ceylon. His purpose was to complete Thomas' Review of Indian Field Mice published in Volume XXII of our Journal.

The late Mr. Fry was associated with the Society's Mammal Survey almost from its inception 20 years ago. On his retirement from the Indian Forest Service he spent his days in the British Museum classifying and arranging the enormous mass of material. Though his name was seldom associated with the scientific papers which appeared in connection with the Survey, yet as a patient collaborator and assistant to those great mammalogists, Thomas and Wroughton, who are now no more, his was a great contribution to the progress of Indian Mammalogy. His loss is felt deeply by the Society and the Mammal Department of the British Museum both of which he served so well and so faithfully.

Birds.—Messrs. Stanford and Ticehurst continued and completed their joint report on the 'Birds of Prome'. The paper was based on the material collected by the first-named author in the Prome district. Two papers were added to the long series of local lists of birds in the Oriental Region which have appeared in our Journal. One was a contribution by The Rev. F. S. Briggs on the 'Birds of Mhow' and the second on the 'Birds of the north-west corner of Fars, Persia', by C. E. Capito. Capt. F. N. Bates contributed a paper on the 'Bulbuls of the Nilgiri Hills'. Of considerable interest was Mr. Salim A. Ali's admirable paper on the 'Nesting Habits of the Bayas', in which he records the results of his careful and painstaking observations and brings to light interesting facts in connection with the nidification and sexual relationship of this common and well-known species.

Reptiles and Fishes.—Mr. J. J. Asana of the Gujarat College, Ahmedabad, contributed an interesting study of the life history of the 'Common Blood-Sucker' (*Calotes versicolor*). During the period under review we published two reports by Mr. D. D. Mukerji of the Zoological Survey of India on 'Collections of Fishes made by two of our Members, Col. R. W. Burton and Mr. R. C. Morris in the Bhawani River and in the streams of the Billigirirangan Hills'. In view of the forthcoming revision of Day's volumes on Fishes in the *Fauna of British India* series, members of the Society could help very materially in collecting fishes from local streams particularly in hill areas. The Society would gladly give all possible assistance in this connection.

Invertebrates.—Parts XXXVI, XXXVII and XXXVIII of 'Indian Dragonflies' by Major F. C. Fraser were published during the year. Other contributions on insects include a paper on the 'Butterflies of Coorg' by Mr. J. A. Yates which supplements Hannyngton's previous list of the butterflies of this province, published in Volume XXIV of the Journal. Many butterflies occurring in Coorg are equally common to Assam and Burma, and the presence of these allied races in areas so far apart is perhaps as difficult to account for as the isolation of Paleartic species in the Nilgiris and Palni Hill ranges. A paper on the 'Butterflies of the Simla Hills' was contributed by Mr. G. W. V. de Rhe Phillipe. In his note on 'Indian Thysanoptera', Mr. T. V. Ramakrishna Ayyar, Madras Agricultural Department, supplements his Memoir on Indian Thysanoptera which appeared in the Memoirs of the Department of Agriculture, Vol. X, and describes 11 new species and one new genus. A paper on the 'Net-veined Midges (*Blepharoceridæ*)' was contributed by Dr. S. L. Hora. The Blepharoceridæ are of special interest to students of animal adaptations and evolution and the object of the author's note is to bring to the notice of collectors the general form and habits of these interesting flies. Other contributions on insects were 'Aspects of the Bionomics of the Lac Insects' and a paper on the 'Locust Cicada (*L. locusta*)' by C. McCann.

Botany.—Parts XIV, XV and XVI of the 'Revision of the Flora of the Bombay Presidency", by Rev. Fr. E. Blatter, S.J., were published during the year. The families dealt with were the *Sterculiaceæ*, *Araceæ* and *Orchidaceæ*. The author in collaboration with Mr. McCann published a description of a new species of *Ceropegia* from the Western Ghats. Further notes on the 'Flowering of Bamboos', supplementing his previous papers on the subject, were also published by Father Blatter.

General.—We were privileged to publish during the year two papers on the "Problem of Evolution", by Lt.-Col. R. Seymour Sewell, Director of the Zoological Survey of India, being his presidential addresses before the Eighteenth Indian Science Congress and the annual meeting of the Royal Asiatic Society of Bengal. The author in the first part of his paper deals with experimental modifications in the bodily structure of animals and shows how in the higher forms of life, including man, a stage has been reached or is being rapidly reached in which further evolution becomes impossible. In the second part of his paper the author develops his theme and indicates the trend of evolution under natural conditions, as expressed in the tendency of the animal to cut off itself and its offspring from the influence of changes in its environment and from just those influences which were responsible for the origin and gradual development of new forms and higher races. The author postulates that man has, or in the near future will have, rendered himself so independent of his environment that this will no longer be able to affect his physical characters and that if there is to be any further evolution this must be the result of his own mental processes.

Economic.—Papers of economic interest published during the year were notes on 'Rats damaging the crops in Southern India' by P. N. Krishna Ayyar. The author indicates the principal species concerned and suggests measures for their control. Mr. Salim A. Ali contributed a paper on 'The Role of Sunbirds and Flower-Peckers' in the propagation of the tree parasite *Loranthus longiflorus*', a common parasite on Mango and other trees in Western India. The author's observations indicate that the life history of the parasite is so inextricably linked with the existence of these birds that the parasite would die out but for their intervention both as regards its propagation and distribution. Papers on the 'Fish Supply of the West Coast of India' were contributed by Sir Reginald Spence and S. H. Prater. The papers were in continuation of a previous article on the subject published by the authors in Volume XXIX of the Journal. The present articles deal with the economic aspect of the fisheries of the West Coast and indicate the principal species of economic importance, the deficiency of the supply and the means for its improvement. The authors also advocate the necessity for the establishment of a Department of Fisheries to investigate and to supply data essential to the commercial development of local Fisheries. Under existing conditions, an important source of food supply to a maritime population has been allowed to recede into comparative oblivion. We would also refer to Dr. H. C. Mueller's Note on 'Sea-Fishing on the Bombay Coast'. Dr. Mueller concludes from his observation of local fishing methods that the line of development should be the improvement of existing methods, not the introduction of methods foreign to the local fisherman. Fishing is now carried out mainly on the edge of the good fishing grounds within the 25-fathom line. The fleet must be in a position to go further and land their catches quicker. If they could continually fish from their boats and make use of all four tides, the result would be many times that of to-day's fishing. They could achieve all this if each village had a few boats fitted with motors, not so much for fishing as for the transport of fish. The fishing area is also circumscribed because of the prevailing method of anchoring boats to permanent stakes. The anchoring of boats in deeper water by means of an ordinary light anchor will be made possible for our fishermen if they have motor-driven winches at their disposal for lifting the anchors out of the soft mud.

Popular Articles.—Mr. Stuart Baker continued his serial on the 'Game Birds of the Indian Empire'. The present series deals with the Wading Birds. Three parts published during the year dealt with the Plovers and Lapwings. Possibly there is no country in the world in which the sportsman meets, as he does in India, such an extraordinary wealth of birds which come so near the border line of game birds, and the intention of the author is to help sportsmen to identify the hundred and one birds which he may, by chance or design, bring to bag in the course of a day's shooting. Two further instalment of Mr. Whistler's 'Study of Indian Birds' were published during the year. The present articles deal very interestingly with the phases of reproduction and nidification in birds. Eight parts of this serial have now been published and two further instalments will appear and when completed the papers will form a very helpful and instructive compendium to students of Indian Ornithology. Parts VI and VII of 'Beautiful Indian Trees' by the Rev. E. Blatter and Mr. W. S. Millard were issued during the period under review. The authors deal with the Cassias which include perhaps the most ornamental and beautiful trees in this country. We should like also to refer to Lt.-Col. F. B. Scot's very interesting and beautifully illustrated paper on 'Indian Hawk-Moths'. The author's object is to rouse interest among our readers and to indicate the lines of study of these beautiful insects, of which about 180 different species occur in the Indian Empire. The paper concludes with notes on the breeding and collecting of Hawk-Moths. We concluded during the year Lt.-Col. A. H. E. Mosse's article on 'The Panther as I have known him'. Other articles of interest to Big Game Hunters were Mr. Morris' article on 'A Bag of Five Tigers' and Col. Burton's 'Burmese Jungle'. We are as anxious as any member to provide articles of popular interest in the Journal. But we have to depend on members themselves for contributions of this nature. There is an infinite variety of subjects of Natural History interest which can be interpreted in readable form. The Editors of the Journal would be only too pleased to consider contributions from readers of the Journal and assist whenever possible in their preparation.

We have again to thank the large number of members who contributed the Miscellaneous Notes published at the end of each number. They form a very readable feature of the Journal and offer an opportunity to every member to add to the interest and usefulness of its pages.

Publications.—The Society issued during the year 'Bird Life in India' by Capt. Bates. The book contains a series of chapters on Birds and Bird Nesting in various parts of India. It is beautifully illustrated with many charming camera studies by the author. The price to members is Rs. 6-12-0.

Forthcoming Publications.—The first Edition of Col. Evans' 'Identification of Indian Butterflies' having been rapidly sold out it was decided to issue a second edition : this edition embodies all the changes and corrections necessary and brings the nomenclature up to date and adds a great deal to what was known of the distribution. The book contains 32 black and white plates and will be ready for issue by the time this report is printed. Orders from members are being registered.

EXPEDITIONS AND EXPLORATIONS.

The study of the bird collections made during the Vernay Expedition to the Eastern Ghats very forcibly brought out the necessity for a survey of the Hyderabad State. Its geographical position in the centre of the Peninsula Region makes it a meeting ground of western and eastern races. Practically no material for the study of the birds of this area is available in any Museum collection. The prevailing financial stringency which has affected Governments, Societies, and individuals alike, made it very difficult to find funds to carry out a survey of this area. This Society is therefore greatly indebted to Mr. Salim A. Ali who offered to carry out this work mainly at his own expense. Work in the field was commenced in November and collections were made in various parts of the State. At the time of writing, Mr. Salim A. Ali is still in the field where he is being assisted by Mr. Henricks of our Bird Department. Our thanks and appreciation are due to Mr. Ali for his zeal and generosity in carrying out this useful work.

Early in 1931, Mr. Henricks was sent to help Mr. Stanford to carry out a survey of the birds of the Henzada District, Burma, on lines similar to his survey of the Prome Division. Mr. Henricks was in the field for two months when disturbed conditions in the Province compelled his return to India.

PRINCE OF WALES' MUSEUM.

Under existing conditions there is little hope that the Trustees of the Museum will be able to give effect to their original plan of building a New Natural History Wing of the Museum. Work in the Natural History Section was confined mainly to the improvement and development of the existing galleries. The most important addition to the galleries is a magnificent group illustrating a pair of tigers drinking at a forest stream. The scene of the group is laid in the forests of the Naga Hills in Assam, where the material was collected and studies for the backgrounds made during the recent expedition undertaken on behalf of the American Museum of Natural History, New York. The clumps of feathery bamboo, the moss-grown boulders of the stream, the background of forest and the soft lighting effects, make a very realistic and effective setting for the tigers. The animals were presented to the Society by Lt.-Col. R. W. Burton and Mr. R. C. Morris. During the year the Mammal Gallery was overhauled and re-arranged. All the show cases were provided with painted backgrounds and the specimens arranged and exhibited to greater advantage. A small group of Gibbons was completed during the year.

Mr. F. V. Evans' generosity enabled us to continue the preparation of models of Marine Fishes of the West Coast. The models so far completed are exhibited in five cases in the Fish Gallery and include most of the important food fishes of Bombay. Mr. Evans has been one of the most generous benefactors of this Society and the Committee once again take the opportunity of recording their thanks and appreciation.

We wish also to express our thanks to those members of the Society who helped us in various fields of work. Our thanks are particularly due :—to Messrs. Whistler and Kinnear for their work in connection with Ornithological Reports of the Vernay Scientific Expedition which has made so great a contribution to the progress of Indian Ornithology,— to Mr. Pocock for his important papers on Indian mammals which have added to the standing and reputation of our journal,—and to Mr. Stuart Baker, Father Blatter and Mr. W. S. Millard who have helped so much to add to the interest of its pages.

STAFF.

The Committee take this opportunity of placing on record their appreciation of the work done by the Curator and his staff, both scientific and clerical.

EXPENDITURE AND RECEIPTS.

The total anticipated income of the Society for the year 1931 was Rs. 40,490-15-0. Actual receipts amounted to Rs. 40,312-4-6 as compared with Rs. 45,293-8-10 during 1930, showing a drop of Rs. 4,981-4-4. The drop in revenue is due to reduced receipts under the following heads:

	1930	**1931**
Life Membership	Rs. 3,500 0 0	Rs. 350 0 0
Annual Subscription	,, 26,781 13 3	,, 25,890 7 11
Sales of Journals	,, 4,208 5 11	,, 1,072 7 6

MEMBERSHIP.

On the 1st of January 1931 we had 1,112 members on our rolls. Of this number 1,047 paid their subscription. Approximately 5% did not pay. Economic depression, increased taxation and retrenchment have had an adverse effect on the activities of the Society and their influence is reflected in the large number of resignations and a serious drop in the recruitment of new members. In normal years there is an inevitable loss of membership through retirements and transfer, but this is usually more than balanced by the number of new members joining. In the last year 137 members resigned while the new members amounted to 47, showing an adverse balance of 90.

A special appeal was issued at the end of last year to members asking for their active co-operation in obtaining new members to make up for the loss that had been sustained. We appeal once again to members for their active help in this connection. The entrance fee has been reduced to Rs. 10 and the annual subscription may be paid now in two instalments.

RETRENCHMENT.

The loss in revenue has compelled us to economise in every way possible and we are now cutting down expenditure to the barest margin. Retrenchment has been effected in the salaries of the staff and in other avenues. It will be also necessary to introduce certain economies in the expenditure on the Journal by issuing fewer coloured plates and limiting the number of its pages. We have consistently endeavoured to maintain a high standard in the Journal and to make it as attractive as possible. We have, we trust, limited ourselves to such economies as will not in any way effect a reduction in this standard.

PUBLICATIONS ACCOUNT.

Game Birds, Vols. I and II. The receipts during the year for sales of these volumes amounted to Rs. 2,240–9–9. The total expenditure from the commencement to date on these volumes was Rs. 65,520–10–8. The amount realised so far is Rs. 60,109–7–11 ; leaving a balance of Rs. 5,411–2–9 still to be recovered. Volume III of this series was published during 1931. The expenditure amounted to Rs. 7,407–15–11. The net amount realised so far is Rs. 5,481–2–7, leaving a balance of Rs. 1,926–13–4 to be realised.

Bird Charts.—These Charts, illustrating 210 Indian Birds in colour, were issued in 1931, at a total cost of Rs. 28,250—we have so far realised Rs. 17,571–5–4 on sales. A thousand sets were ordered from our printers. This number was based largely on orders previously received from schools and educational institutions. Unfortunately, retrenchment by Provincial Governments in the grants to schools has prevented many of them from taking up so far the charts which they had ordered from the Society.

These coloured illustrations of Indian Birds, made up in the form of charts, fill a long-felt need. In their present format they are perhaps inconvenient for individual use. It has been decided to issue a limited number of copies of these pictures bound in book form. Members who would like to acquire copies should register their orders with the Society.

REGINALD SPENCE,
Joint Hon. Secretary.

22nd. March, 1932.

BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT DECEMBER 31, 1931

LIABILITIES	RS A P	*Rs a p*	*Rs a p*
Life Membership Fees		......	46,100 0 0
Donations for specific objects unexpended :			
Show Cases, etc.		2,813 3 4	
Building Fund		15,225 10 0	
Field Museum for collecting expenses ...		7,000 0 0	25,038 13 4
Sundry Creditors :			
For publication of "Fish" Pamphlets...		1,673 6 0	
,, ,, ,, Brigadier Evans' Butterfly Books		1,609 2 8	
Printers of Journals		3,105 0 6	
,, ,, Game Books, Vol. III ...		1,926 13 4	
,, ,, Bird Charts		5,062 9 0	
For Expenses		250 0 0	
Author's Profits		150 0 0	13,776 15 6
Surplus Assets—		32,761 5 2	
Add: Balance from Publication Account		543 7 5	
		33,304 12 7	
Less: Loss on Revenue Account	2,447 8 8		
,, Depreciation of Investments	9,450 0 0	11,897 8 8	21,407 3 11
Total ...			1,06,323 0 9

ASSETS	*Rs a p*	*Rs a p*
Investments at par or market value whichever is lower :		
Rs. 28,000 Govt. 3½% Notes at 51-13/16% ...	14,507 8 0	
,, 10,000 ,, 4% 1916/17 Loan at 84-4%.	8,425 0 0	
,, 15,000 ,, 5% 1944-55 at Rs. 90 ...	13,500 0 0	
,, 8,000 Bom. Dev. Loan 1935 at 6½% at par.	8,000 0 0	
,, 14,000 Port Trust 4% Bonds at Rs. 57%.	7,980 0 0	
,, 15,000 Imp. ,, 4% ,, at Rs. 57½%.	8,625 0 0	61,037 8 0
Investments on account of building fund :—		
Rs. 10,000 Govt. 6% 1933-36 at Rs. 94 ...	9,400 0 0	
,, 500 ,, 5% 1944-55 at Rs. 90 ...	450 0 0	
Fixed Deposits	5,355 10 0	15,205 10 0
Cash—		
With National Bank of India Ltd., in Current Account	2,456 4 7	
With National Bank of India Ltd., London £24-6-1 at 1/6	324 0 11	
On Fixed Deposit	10,000 0 0	
On hand	150 0 0	12,930 5 6
Sundry Debtors	...	1,563 0 0
Furniture :	1,965 0 0	
Less Depreciation	150 0 0	1,815 0 0
Publications, excluding Journals—		
As certified by the Secretary	...	500 0 0
Note.—Any publications which have been on hand over 2 years have been written off.		
Game Books, Vol. III Stock on hand as certified by the Secretary	...	2,137 2 5
Bird Charts, Stock on hand as certified by the Secretary	...	9,122 3 4
Bates Bird Life, Stock on hand as certified by the Secretary	...	1,532 3 6
Beautiful Indian Trees :		
Stock on hand as certified by the Secretary	...	480 0 0
Game Books Vols. I & II at *Cost :* ...	65,520 10 8	
Less : Realised to date	60,109 7 11	
	5,411 2 9	
Already written off in previous years...	7,651 12 6	
Transferred to Revenue A/c.	2,240 9 9	
Total ...	...	1,06,323 0 9

Note.—50% of any book profits to be paid to Authors. A stock of 18,000 old Journals and the valuable Research Collection and Library of 2,400 volumes have not been taken into account on the asset side of the Balance Sheet.

We have prepared the above Balance Sheet from the cash book and from information given to us, and have verified the investments and deposits. In our opinion such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and the explanations given to us.

BOMBAY, *February 25, 1932.*

A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

(Sd.) A. FORRINGTON,
Honorary Treasurer.

BOMBAY NATURAL HISTORY SOCIETY.

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1931.

	Rs a p	Rs a p		Rs a p	Rs a p
To Salaries	17,821 5 6		By Entrance Fee	950 0 0	
,, Society's Contribution to Provident Fund	1,580 8 0		,, Subscriptions	25,890 7 11	
,, General charges	1,108 11 11		,, Interest	4,611 0 10	
,, Rent	2,436 0 0		,, Life Membership	350 0 0	
,, Printing and Stationery	607 9 3		,, Sales of Journals less Expenses	1,022 7 6	
,, Postage	1,227 8 3		,, Taxidermy Dept.	106 11 6	
,, Library	385 11 5		,, Game Books, Vols. I and II.	2,240 9 9	
,, Furniture depreciation	150 0 0			35,171 5 6	
,, Fire Insurance	100 0 0		,, Loss	2,447 8 8	
,, Audit Fee	250 0 0				37,618 14 2
,, Cost of Journals	11,951 7 10				
		37,618 14 2			
Total	...	37,618 14 2	Total	...	37,618 14 2

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1931.

	Rs a p	Rs a p		Rs a p	Rs a p
To Author's Profit on Snake Book	150 0 0		By Sales—		
,, Balance carried to Surplus Assets	543 7 5		,, Snake Charts	169 0 0	
			,, Snake Books	330 7 8	
		693 7 5	,, Society's Publications	193 15 9	
					693 7 5
			,, Sales of Bird Charts during the year	11,860 5 4	
,, Messrs. Vitty & Seaborne Ltd., London for Bird Charts.		20,982 8 8	,, Stock on hand	9,122 3 4	20,982 8 8
,, Bates Bird Life in India		3,034 3 6	,, Sale Proceeds from Bates' Bird Life in India.	1,502 0 0	
			,, Stock on hand	1,532 3 6	3,034 3 6
,, Game Books, Vol. III		4,503 5 11	,, Sale Proceeds Game Book, Vol. III	2,366 3 6	
			,, Stock on hand	2,137 2 5	4,503 5 11

BOMBAY NATURAL HISTORY SOCIETY

INCOME AND EXPENDITURE
ACCOUNT OF DONATIONS FOR SPECIFIC PURPOSES FOR THE YEAR ENDED 31st DECEMBER 1931.

	Rs a p		*Rs a p*	*Rs a p*
To Expenditure on show cases, Modeller's salary etc.	2,690 5 3	By Unexpended balance for Show Cases as per last Balance Sheet	3,803 8 7	
,, Depreciation of Building Fund Investments	650 0 0	Unexpended balance for Building Fund, as per last Balance Sheet	15,645 0 0	
,, Balance carried to Balance Sheet	25,038 13 4	Donations for Show Cases, etc.	1,700 0 0	
		,, ,, expenditure (Field Museum)...	7,000 0 0	
		Interest on Building Investments	230 10 0	28,379 2 7
	28,379 2 7			28,379 **2** 7

BOMBAY, *25th February, 1932.*

Examined and found correct.
(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

(Sd.) A. FORRINGTON,
Honorary Treasurer,

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